# COMMERCIAL FISHERIES Review

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COVER: Concentrating menhaden in pocket of purse seine prior to transferring fish to vessel by pumping. (Photo: Bob Williams)

# *COMMERCIAL FISHERIES*

## *Review*

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.


Fishermen's Memorial
Gloucester, Mass.

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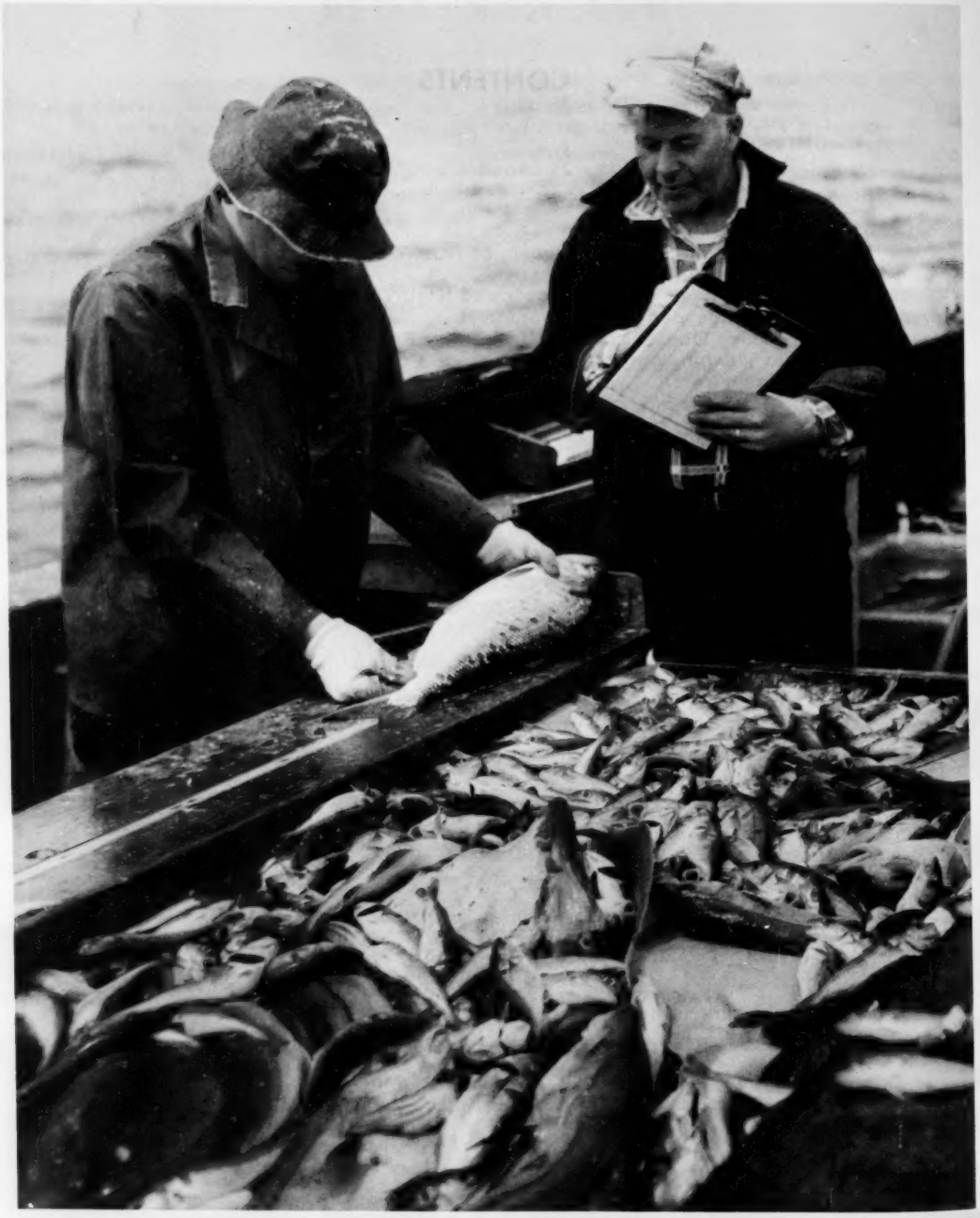
TO CFR READERS

A mix-up in the printer's mailing of the June 1969 COMMERCIAL FISHERIES REVIEW has delayed delivery to most readers. We regret the inconvenience.



Biologists measure fish aboard BCF vessel to assess fishing's effect on population. Thousands must be measured to determine growth and mortality rates. (R. K. Brigham)

# FISH PRICES HIGHER IN 3RD QUARTER 1969 THAN YEAR EARLIER

Although some fish prices dipped seasonally in the third quarter of 1969, most prices were generally higher than in the same period of 1968. This had been predicted by BCF's Division of Current Economic Analysis.

Wholesale prices have been running about 10% higher than last year's, but fresh fish wholesale prices have risen an average of about 14%. Prices for several frozen products have been up about 10%. Wholesale prices for a limited number of canned products averaged fractionally lower.

Supplies

Supplies of most fishery products--haddock is a notable exception--are expected to increase seasonally and be ample for the remainder of the summer.

As of July 1, inventories of frozen fish and shellfish were about 5% above a year earlier. Stocks of shrimp, crabs, and lobster tails were much larger. Fillets and steaks were up 7%--but were offset by lower stocks of round and dressed fish. Stocks of fish sticks and portions were 18% above 1968; production rose 25% in first quarter. Freshwater-fish stocks were about the same as in 1968.

Landings

Landings of the popular New England fish have decreased about 8% this year. Haddock was a third less than the low level of 1968, and ocean perch was off 13%. But flounder and cod were up substantially.

California tuna landings, used primarily for canning, were up 45% due to the heavy catch of yellowfin in the tropical Pacific.

Fish Meal

Three factors are important in determining how much fish meal is used in the U.S.--the number of broilers hatched, fish meal prices, and prices of competing feed ingredients. Broilers hatched in January-May were 7% over last year. In June, menhaden meal was $172 a ton f.o.b. East Coast ports; Peruvian meal was $168.

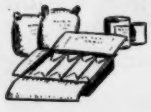
Fish Meal vs. Competitive Products

Fish meal prices also were high in relation to competing products, such as soybean meal. If the high prices and price ratios continue through third quarter, the use of fish meal could fall considerably, as it did in 1965 and 1966 during periods of high prices. It was estimated that, at June prices, fewer than 250,000 tons of meal would be used in third quarter. This would be about one fourth below third-quarter 1968 consumption.

Fish Oil & Solubles

The U.S. consumed 11.2 million pounds of fish oil in first 4 months of 1969--up 5% from last year. Exports were 53.8 million pounds, nearly triple the amount exported in 1968. It was estimated that 8-12 million pounds of oil will be used in third-quarter 1968--slightly above last year. Exports were expected to be at least 21 million pounds.

Declining prices of fish solubles in first 5 months of 1969 indicated relatively weak U.S. demand. Prices of menhaden solubles fell from average $51.25 per ton, f.o.b. East Coast ports, in January, to $47.75 in May. In late May, prices began to increase and averaged $49.75 per ton in June. This increase could indicate an increase in demand. In May 1969, consumption of fish solubles was about 11,100 tons--an increase of over 75% from May 1968.



# UNITED STATES

## Catfish Farming Grows in the South

A "new" agricultural industry--centuries old in Europe and a thousand years old in Asia--is on the rise in several southern States: catfish farming for sport fishing and commercial sales.

The main catfish-farming States today are Arkansas, Alabama, Mississippi, Louisiana, and Texas. There are more than 700 individual enterprises on over 30,000 acres of farm ponds. These produce about 39 million catchable or market-size catfish and over 50 million fingerlings. Current wholesale value of the "crop" is about $10\frac{1}{2}$ million. Income from bait minnows, also raised on fish farms, is $8\frac{1}{4}$ million.

The most profitable arrangement, one encouraged by fish culturists, is a fish-rice-soybean rotation that makes fish farming part of agriculture.

### Government Aid

The Bureau of Sport Fisheries and Wildlife and BCF work closely with the States to conduct basic research and to provide technical assistance. The U.S. Department of Agriculture provides financial and technical assistance to build and stock ponds. Investigations cover all of fish husbandry--rearing, feeding, stocking, and disease control.

### Beginning of Fishery

Catfish culture was first considered seriously in the U.S. in 1917. Notes on rearing, growth, and food of channel catfish, in 'Transactions of the American Fisheries Society,' were based on research by the old U.S. Bureau of Fisheries. But it was not until the late 1940s that research at Auburn University, University of Oklahoma, and U.S. research at Marion, Ala., and Stuttgart, Ark., found catfish-rearing feasible. State hatcheries, especially in Arkansas, then helped. Later, private initiative and capital began to take over, and industry spread.

### Recreational Use

Perhaps one-fifth of today's anglers fish in farm ponds. Many children and adults cast their first line and learned to catch a fish in such waters. Anglers can fish only a few minutes and miles from home or office. They can fish a couple of hours in the cool of a summer morning or evening, in the afternoon of warm winter days, or between April showers.

Good pond management can be carried out by the owner in his spare time. Fertilization of water, or use of commercial feed, increases the pounds per pond; angling fees bring in extra cash; farmers simply harvest fish fish to sell on the market.

### Good Future for Farming

The Bureau of Sport Fisheries and Wildlife sees a good future for fish farming. More people are accepting catfish for food and sport. The Bureau expects cost-per-pound to drop, production per man-year and production per acre to rise. The Bureau also expects current research to produce catfish that grow faster, are hardier in the winter, and more resistant to disease.

## Temperate Tuna Forecasting Is Expanded

Fishermen operating in Oregon-Washington waters this year are receiving additional radio advisory materials through a joint BCF-Oregon State University (OSU) cooperative project. OSU is operating an albacore information service from July 1 to October 1. It is emphasizing sea surface temperatures and concentrating on microscale features along the Oregon coast out to 200 nautical miles.

### Daily Messages

OSU transmits a daily message through the Astoria Marine Operator. The messages

are part of the normal weather broadcast at 1015 PDST and 2215 PDST. Each message is run twice; the new message will be the evening one.

In addition to information from BCF's Fishery-Oceanography Center at La Jolla, Calif., and the Weather Bureau, OSU receives reports from aircraft equipped with infrared thermometers, research vessels, and fishing boats (11 outfitted with bathythermographs).

## San Pedro Wetfish Fleet Is In Poor Economic Condition

Two BCF specialists, an economist and a fishery biologist, recently completed a study of the economics of the San Pedro, Calif., wetfish fleet. Wetfish include jack mackerel, Pacific mackerel, anchovy, and Pacific sardine.

The Findings

They found the fleet in an unhealthy economic condition: low profits, unusual capital structure, low crew earnings, and decreasing employment. However, despite the overall depressed condition, a few boats have made reasonable profits in recent years. This fact--plus favorable cost analyses of existing vessel types, good estimates of some wetfish stocks off California--may indicate that, with proper market conditions, fleet expansion with surplus vessels from other fisheries would be economically feasible.

New Vessels Uneconomical

At present catch rates and prices, cost analyses show that new vessel construction would not be economically feasible, even with construction subsidies. If catch rates and efficiency were increased through technological research, the situation might change.

## Pacific Halibut Landings Increase

Pacific halibut landings by the U.S. and Canadian fleet through July 31 were 35.3 million pounds (dressed weight). This is an increase of 3.3 million pounds, or 10%, over the 1968 period. For the first time since 1966, quotas in most fishing areas were expected to be reached.

High Prices Stabilizing Factor

High prices should keep the vessels from shifting to other fisheries as they did last year, when prices were much lower. Prices have continued upward since the season opened. At the beginning, exvessel prices for medium halibut were 40.6 cents a pound in Seattle, Wash., and 41.6 cents at Prince Rupert, British Columbia. On July 31, prices for medium halibut had reached 45.3 cents at Seattle, and 44.2 cents a pound at Prince Rupert.

## Lake Erie Fishermen Reject 30-40% of Catch

Biologists from BCF's Sandusky, Ohio, field station on Lake Erie are investigating the number and species of fish commercial fishermen land and then return to the lake. Working with beach seiners in Sandusky Bay, the biologists report about 40% of the fish are returned for lack of market demand. Most are sheepshead, goldfish, carp, and gizzard shad. A similar situation exists in the trap net fishery, where about 30%, usually the same species, are returned. This selective fishery may be contributing to the lake's undesirably high abundance of unmarketable fish.

## Fish Oil May Be Marketed For Human Consumption

Representatives of BCF's Division of Food Science met recently with members of the fish industry to discuss the feasibility of bringing fish oil to the U.S. human food market.

BCF is cooperating with industry and other government agencies to reintroduce fish oil as human food.

Sardine Oil Used 1912-1952

Oil from California sardines was used in human foods in the U.S. from 1912 through

1952. Failure of the resource, and lack of information on using oil from other species, brought in vegetable oils to fill the market void. The menhaden industry particularly is interested in marketing fish oil for people. With the recent emphasis on good manufacturing practices, and esthetic considerations for all human food, present practices must be changed before oil can be used.

## Biologist Tests Effects of Lunar Materials on Aquatic Species

James W. Warren, a fish biologist with the Bureau of Sport Fisheries and Wildlife, will test the effects of lunar materials on earth's aquatic species at Houston's lunar receiving laboratory.

Species Used

Warren will work for 2 months with species ranging from small protozoans to flat worms, oysters, shrimp, and fathead and mummichog minnows. The minnows, he says, are something like "guinea pigs of the fish world"--much is known about their normal condition and they are, in many ways, ideal as a laboratory test species.

The main objective of these experiments with moon dust is to detect any elements that may jeopardize life on earth.

Preliminary Tests

Warren emphasizes that his experiments will be only preliminary: to see if any hazards exist before the moon dust is sent to other scientists for more comprehensive studies. His tests will begin after a team of physicists and geologists has spent 3 weeks intensively examining the material for gross cosmic radiation or chemical hazards. These researchers then will distribute the dust to special test groups. Warren's 5-man aquatic research team is one of these groups.

## BCF Studies Shrimp-Sorting Trawls in Pacific Northwest

BCF's Exploratory Fishing Base in Seattle, Wash., reports that 3 gear-development cruises involving studies of shrimp-sorting trawls were conducted between April 1 and June 30, 1969. Several trawls incorporating various sorting concepts were evaluated. Trawl performance studies involved observations by SCUBA-equipped personnel during shallow-water testing, and actual test fishing on commercial fishing grounds.

The Findings

Findings revealed that trawls equipped with a vertical sorting panel eliminated virtually all trash fish and invertebrates from the shrimp catch; some smelt and a few small rockfish were retained. The research model--a 3-panel shrimp trawl--was most effective in eliminating trash. Trawls without headrope overhang retained fewer smelt than those having an overhang; this occurred without any apparent change in shrimp catch. Contamination of sorting trawl catches was always less than that found in commercial catches by nearby vessels.

## BCF Tests Fresh Halibut Stored in Refrigerated Sea Water

A BCF technologist went to sea early in June to begin a study of halibut stored in carbon dioxide ($CO_2$) treated refrigerated sea water (RSW). He returned to Seattle, Wash., with freshly caught fish in an RSW unit. The unit was transferred to the laboratory without disturbing the fish in the holding tank. The halibut will be evaluated periodically to determine the effect of the $CO_2$ treatment on quality and storage life, compared to those of iced 'control fish.'

Bacterial Counts

The first examination was made on June 25 after the fish had been held 21 days. The halibut held in RSW-$CO_2$ were in excellent condition. Total bacterial counts had not risen above 100 organisms per square centimeter of skin. The bacterial load in the sea water itself was 100 organisms per milliliter.

By comparison, total bacterial counts on the iced control fish were in excess of 1,000,000 organisms per square centimeter of skin. Initial bacterial counts on the fish, prior to storage, were 10,000 organisms per square centimeter.

Sensory Tests

Organoleptic (sense organ) assessment of raw fish clearly indicated that the iced halibut were in very poor condition. Similar assessment of the $CO_2$-treated RSW halibut showed these fish to be in good condition.

## U.S. & Japan Cooperate in Salmon Research

Scientists of Japan's Hokkaido University and BCF are working together to learn more about the early marine life of Alaska's Bristol Bay sockeye (red) salmon. They are interested also in the salmon's environment.

Biologists at BCF's Auke Bay (Alaska) Laboratory are trying to discover the seaward migration routes of Bristol Bay young sockeye salmon. Their study is part of a comprehensive investigation to improve the accuracy of salmon run forecasts.

Japanese Invitation

This year, Hokkaido officials invited BCF's Dr. Richard Straty to board the 'Oshoro Maru' during its Bristol Bay cruise. The vessel is used primarily to train graduate fishery students. BCF saw this as an excellent opportunity to coordinate its Bristol Bay efforts with those of the Japanese.

Under Straty's supervision, BCF and Hokkaido researchers established the present cooperative effort. The two groups thus will avoid costly duplication and collect much more scientific information.

Seek Marked Salmon

The main task of 2 research vessels will be to collect young sockeye salmon migrating seaward through the Bering Sea. Researchers hope to find some salmon bearing fluorescent marks. These will represent part of over 750,000 young salmon marked earlier this summer on the Wood and Naknek Rivers, before starting their long ocean journey. Their recapture will give BCF biologists valuable information on migration routes. By using 2 research vessels, BCF and Hokkaido biologists will be able to gather data from a much wider area in Bristol Bay. Once the information is analyzed, the scientists will exchange findings.

## BCF Conducts Tuna/Porpoise Survey in Eastern Equatorial Atlantic

A BCF Biological Technician is exploring the eastern equatorial Atlantic to gather information on the association of tuna with porpoise. His prime interest is sampling the virtually unfished porpoise populations of the Atlantic for comparison with data from the eastern Pacific. In the Pacific, tuna and porpoise frequently school together. The schools are located by sighting the jumping or "spinning" porpoise.

Porpoise caught in purse seines in attempts to catch tuna are released by fishermen.

The Operation

Traveling with a commercial tuna seiner, a transshipment vessel, and a scouting helicopter, the technician will observe and photograph their operations. He also will collect tuna length frequency data, tuna blood samples, stomach contents of tuna, size and sex data on the porpoise catch, and photograph and measure porpoises.

## Financial Aid Provided for Fishing Vessels

The Federal Fisheries Loan Fund program, administered by BCF, began in 1956. Through June 30, 1969, BCF had received 2,259 applications for $62,783,447. Of these, 1,187 ($29,002,714) were approved; 685 ($16,859,072) were declined or found ineligible; 349 ($12,585,271) were withdrawn before processing; and 38 ($1,904,505) were pending.

As 418 were approved for smaller amounts than applied for, the total was reduced by $2,431,885.

Mortgage Insurance Program

BCF also administers the Fishing Vessel Mortgage Insurance Program. Since the program began on July 5, 1960, 240 applications for $31,837,977 have been received. By June 30, 1969, 199 for $24,198,828 had been approved, and 11 for $4,262,401 were pending.

Fishing Vessel Construction Subsidies

The first applications for fishing-vessel construction subsidies under the expanded program were received in December 1964. By June 30, 1969, 119 applications for an estimated $32,191,100 had been received. Sixty were approved for an estimated $14,732,000. Thirty-two, for $18,604,748.70, have been executed. Some provide for greater subsidies than were estimated.

## U.S. and 9 States Discuss Control of Water Pollution

The first in a series of meetings between Federal and State officials to coordinate plans for water pollution control was held August 6 in the offices of Carl L. Klein, Interior Department's Assistant Secretary for Water Quality and Research.

Interior Secretary Hickel said: "We are going to do everything we can to clean up the Nation's waterways. In working towards this goal, we intend to establish a close coordination and correlation between State and Federal policy making on this vital issue."

National Problem

The first group of conferees included representatives from New Jersey, Pennsylvania, Illinois, New York, Colorado, Washington, South Carolina, Vermont, and Nebraska. No attempt is being made to arrange the meetings along regional lines. The problems being discussed concern the whole country and cover the future of water-pollution control. These include regulation of thermal pollution, coastal waste disposal, deep well disposal, the "highest practicable treatment" of wastes, and Federal-State problems generally.

## Record Run of Spring Chinook in Columbia River

A record run of spring chinook was tallied over Bonneville Dam this year--174,143 fish. Although the run was quite strong, there were some difficulties. Some fish were killed, probably from the high nitrogen content caused by spillway discharges at various dams on the Columbia. Because of the high nitrogen values, it was impossible to assess accurately the loss to either adults or seaward migrants. However, both juvenile and adults were noted in distress at various points along the river.

Lewiston Dam Escapement

Escapement of spring chinook over Lewiston Dam into the Clearwater River, Idaho, had exceeded 2,600 fish by June 30. They had passed through the 2 fishways rebuilt under the Columbia River Fisheries Development Program. The return was from eyed eggs planted in incubation channels in the Selway River; this was a cooperative effort of BCF and the Idaho Fish and Game Department.

Fall Creek Run

The spring chinook run was heavy in Fall Creek, a tributary of the Willamette River. By June 19, 4,001 adults had been trapped at Fall Creek Dam. In contrast, the total 1968 Fall Creek chinook count had been only 80 fish. Because of concern about saturation of spawning areas in tributaries above the reservoir, trapped chinook were being transported to Green Peter reservoir in the South Santiam River.

## Bonneville Hatchery To Be Enlarged

The U.S. Corps of Engineers will finance enlargement of Bonneville Hatchery to compensate for the flooding of spawning grounds by John Day Dam. The new hatchery, sized

at 66 ponds, will have a complete reuse-water system capable of heating and chilling the water.

The Corps also has installed stoplogs in the draft tube unwatering slots at Lower Monumental Dam. This has alleviated the problem of fish entering the skeleton bays and becoming entrapped. Fish passage now is considered good.

## Columbia River Water Temperatures Predicted

Exploratory temperature tests of the Columbia River have been completed by the Corps of Engineers Hydraulic Laboratory, Bonneville, Oregon. A physical model of the lower Columbia was used to determine the physical characteristics of heated discharges from a proposed thermonuclear plant near the Kalama grain dock.

Methods & Results

The dispersion characteristics of the temperature plumes were measured and recorded with Rosemount temperature sensing and recording devices. The dye plumes were recorded visually. The temperature plumes were photographed with an infrared optical system. Cursory examination of the data indicated that: (1) dye plume factors do not necessarily coincide with temperature plume limits, (2) heated water can become trapped in eddy areas, and (3) under all conditions, a temperature increase was recorded at Coffin Rock, 5 river miles downstream from Kalama, the site of another thermonuclear plant.

Tests with Fish

In other tests, juvenile salmonids were subjected to lethal temperature for a sublethal period. The treated fish were mixed with a like number of untreated control fish and placed in a large tank containing predators. The test was terminated after 2 hours. Twenty-eight of 60 treated fish had been eaten, compared with only 1 of the 60 untreated fish.

## Seattle Gets Ready for FISH EXPO '69

One of the world's largest fishing shows, FISH EXPO '69, is scheduled to open in the Seattle, Wash., Coliseum on October 5. It will run 4 days. The show will feature marine exhibits, well-known speakers, panel discussions and seminars, 3 banquets, and sightseeing tours and activities.

Dr. Richard Van Cleve, University of Washington School of Fisheries and seminar program chairman, has announced this schedule:

Mon., Oct. 6, 1969

9:30-10:45 a.m. - The Electronic Detection of Fish--chaired by Dr. Murphy, director, Division of Marine Resources, U. Washington.

11:00 a.m.-12:30 p.m. - The Captains Speak Out--featuring representatives from South America, Europe, Canada, the U.S. West Coast, East Coast, and Gulf Coast.

Tues., Oct. 7

9:30-10:45 a.m. - Quality Control Ashore and Afloat--chaired by Dr. Pigott, U. of Washington.

11:00 a.m.-12:30 p.m. - The Lay System (share system in the boats)--chaired by Mr. Sig Jeager; will include representatives from each coast.

Wed., Oct. 8

9:30-10:45 a.m. - Transportation and Marketing of Fresh Fish and Shellfish--expansion of markets through air transportation, containerization of fish--chaired by Roy Stevens.

Tentative tours have been set:

Mon., Oct. 6--Open House about noon at Fishermen's Terminal aboard BCF's 'Miller Freeman.'

Tues., Oct. 7--New England Fish, Marco, and other industry points of interest in Seattle area. Morning and afternoon.

Wed., Oct. 8--U. of Washington School of Fisheries and BCF's Montlake Laboratory. Morning and afternoon.

Buses will shuttle from Center Coliseum to tour points.

FISH EXPO '69 is the third in a series. The previous 2 were held in Boston, Mass.

## Fraser River Salmon Outlook Is Promising, Commission Believes

The outlook for the sockeye and pink salmon in the Fraser River system of British Columbia is promising, states the 1968 annual report of the International Pacific Salmon Fisheries Commission. The Commission was appointed under a Canada-U.S. Convention to protect and expand these resources. Its recommendations are important to Canadian and U.S. fishermen.

The Commission's study of the salmon fisheries of 2 other major river systems on the Pacific coast--California's Sacramento-San Joaquin River system and Washington State's Columbia and Snake Rivers--"leads to an optimistic forecast for the future of the Fraser River salmon fishery."

The Sacramento-San Joaquin River system, once a major producer of chinook salmon, lies in semi-arid, very valuable, farm land. The available river flow is being developed to full capacity, for irrigation primarily, but also for domestic and industrial water supplies. The fishery has suffered. The Fraser River watershed, in contrast, enfolds only a limited amount of farm land that needs extensive irrigation. In this respect, only a major diversion of the Fraser River to other areas would threaten the salmon fishery.

The Columbia River salmon, too, "has declined substantially." Decades ago, irrigation development "destroyed or permanently decimated" the salmon population of major tributaries. More recently, the main Columbia and Snake Rivers have been utilized for hydroelectric power. The salmon of the upper Columbia and Snake Rivers "are now declining in abundance and may eventually become of little commercial importance." Protecting the Fraser system is the policy of the British Columbia Government. It has opposed development of the Fraser's hydroelectric capacity until there are improvements in thermal generation of electric power. So the Commission concludes: "From this we gain confidence that the salmon industry of the Fraser River will not be affected by the disastrous forces which are impairing or have destroyed major salmon producing areas in the Columbia and Sacramento-San Joaquin Rivers." This policy is "all-important to the future of the fishery."

### HISTORY OF FRASER SALMON

From 1911-1913, railroad construction produced an obstruction at Hell's Gate, northeast of Vancouver, B.C., which had a "devastating effect" on the annual upstream migration of Fraser River salmon. Annual sockeye production dropped 87% from an average 9.5 million sockeye for 1899-1913 to 1.2 million for 1921-24. Beginning in 1913, the extensive pink salmon escapements above Hell's Gate disappeared. The abundance index of this species declined 76%.

Sockeye Salmon (Oncorhynchus nerka)

The serious effects of Hell's Gate obstruction led to the Sockeye Salmon Fisheries Convention ratified by Canada and the U.S. in 1937. The International Pacific Salmon Fisheries Commission was created "to protect, preserve and extend the fishery for this species." After 8 years of scientific study, the Commission took on regulatory responsibility. In 1945, the major Hell's Gate fishways were completed. The next year, new regulations became effective to adjust fishing "in the interest of conservation and division of the catch."

Production History--Fraser River Sockeye

| Years | Average Annual Catch | Value to Fishermen | Processed Value |
|---|---|---|---|
| | | 1968 Prices | |
| 1898-1913 | 9,494,000 | $22,008,500 | $39,115,000 |
| 1921-1924 | 1,213,000 | 2,812,000 | 4,997,500 |
| 1958-1961 | 4,770,000 | 11,058,000 | 19,653,000 |

The years 1958-1961 are used to show current production because bad environmental conditions during 1962-1966 reduced temporarily the production of sockeye and pink salmon. Since 1966, the Commission reports, "reproductive environment and survival rates appear to be regaining favorable levels, but a full quadrennial cycle has not been completed."

Fraser River pink salmon runs also declined seriously after the Hell's Gate slide--"but have recently begun to return to their

Pink Salmon (Oncorhynchus gorbuscha)

former abundance." It has been estimated that the 1967 pink salmon catch, worth $6,380,000 to fishermen and $18,676,000 in processed value to Canada and U.S. at 1968 prices, eventually can be doubled and perhaps tripled. The escapement above Hell's Gate is increasing to large levels again and the potential production may be achieved "in a few cycle years of favorable survival rates."

When the values for sockeye and estimated minimum values for pink salmon (twice 1967 production) are combined, the original populations before the 1913 disaster were worth an estimated $28,389,000 a year to fishermen--and $57,791,000 after processing to Canada and U.S. based on 1968 prices. Immediately after the 1913 slide, the industry's value dropped to $4,950,000 to fishermen and $11,254,000 processed; it has recovered "due in a large part to the operations of the Commission." Now, annual value is $14,248,000 to fishermen and $28,991,000 after processing--an annual increase of $9,298,000 and $17,737,000 over the previous period.

Restoring Fraser's Original Wealth

Several factors will determine whether Fraser River will regain its original sockeye and pink salmon wealth. Some transplants may be necessary because, in some cases, "the original racial structure of the populations was destroyed." A second factor is "the change in the reproductive environment brought about by logging of the watershed." Only artificial aids can prevent some declines. The Commission has investigated artificial spawning channels, incubation channels, temperature control, and artificial rearing. "These artificial aids will act not only as substitutes for lost or damaged spawning grounds, but also as potential methods for extending the populations to levels greater than those possible under natural conditions."

The Commission believes that "the rehabilitation picture may change within the next two years." More data on returning adults will justify the rapid expansion of artificial aids to sockeye and pink salmon reproduction.

## SOCKEYE SALMON FISHERY

The 1968 run of Fraser River sockeye entering Convention waters was 2,559,301 sockeye: 1,805,962 caught commercially, an estimated 124,002 by Indians, and 629,337 recorded on spawning grounds. Another 355,000 fish were caught in Johnstone Strait. The commercial sockeye catch was much larger than the brood year catch in 1964 of 1,023,000.

Of the 1,805,692 sockeye, Canadian fishermen caught 920,092 and U.S. fishermen 885,870--about 51% and 49%. The catch in Convention waters was 77% above that of the brood year 1964. The average weight of 4-year-old sockeye was 5.81 pounds, slightly smaller than the cycle average of 6.04 pounds.

The Canadian fishery in Juan de Fuca Strait was closed during passage of the main 1968 sockeye run because the expected run was considered too small to permit a practical fishery.

The 1968 U.S. purse-seine and reef-net fleets were the smallest of any recent cycle year. So the sockeye catch by these gear was the smallest since 1964. The gill-net fleet, with more vessels, harvested about 40% of the catch; in 1964, 35%; in 1960, 21.12%.

Escapement

The net escapement of 629,337 sockeye was 24.6% of the 1968 run to Convention waters and 21.6% of the calculated total run. Most individual escapements were higher than those in the brood year. These increases were attained mostly because of favorable marine survival of all races.

The 1968 spawning escapement "was most satisfactory and spawning conditions were generally favorable."

## REHABILITATION

From 1949-1962, the Commission experimented with eyed-egg transplants to barren streams that reportedly had sockeye runs in earlier years. It achieved minor successes in beginning sockeye runs that now are self-sustaining. "However," the Commission

states, "the degree of success of these transplants has not been of major commercial importance to date," although the investment was more than justified.

The Commission studied the reasons why previous sockeye hatchery operations failed to build up Fraser River runs. It found that "hatchery-produced fry are smaller and weaker than wild fry, develop sooner and thus enter their lacustrine (growing in lakes) life earlier than normal." For these reasons, enough hatchery-produced fry did not survive to increase the returning runs. "However, research by other organizations on coho and chinook salmon has shown that the adverse effects of hatchery incubation can be offset by artificial rearing of fry, with economic benefits gained in terms of adults produced."

The Commission has been forced to use artificial aids to maintain certain runs for 2 reasons: 1) increasing instability of several natural spawning grounds of pink and sockeye salmon caused by watershed logging, and 2) loss of valuable pink salmon spawning ground on Seton Creek due to hydroelectric power development.

The Commission believes that yearling sockeye smolts can be produced successfully by artificial rearing if these procedures are followed:

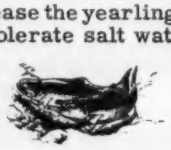
"Limit spring and summer rearing to self-cleaning, rectangular circulating ponds of the type developed by Roger Burrows of the United States Fish and Wildlife Service. These ponds eliminate waste products rapidly and create a uniform environment with a resulting uniformity in the distribution of fish.

"Exercise care in pond loading in respect to available space and water supply.

"Use care in all fish cultural practices, especially in the initial feeding of young fry.

"Maintain daily fluctuation in water temperature to restrict the outbreak of both bacterial gill disease and virus infection.

"Do not release the yearling fish until they are known to tolerate salt water."



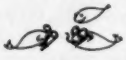
## BCF Home Economist to Broadcast in Spanish

A BCF home economist will conduct a live, public-service broadcast over the Spanish-language radio station KCOR, San Antonio, Texas, on November 4. She also will tape 30- and 60-second public-service spot announcements. The tapes will be mailed to 80 Spanish-language radio stations throughout the country.

## Trout Farmers Meet In October

The U.S. Trout Farmers Association (USTFA) will meet at Traverse City, Mich., October 8, 9, and 10, reports Jay N. Roundhouse, USTFA president, and convention chairman. The convention will include one day of touring trout farms and hatching facilities. The first and last days will be devoted to cultural problems and to marketing. The potential of recreational trout farming will be emphasized.

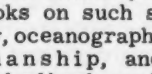
About 180 trout growers and those of allied industries and professions attended the 1968 convention. Roundhouse expects as many this year.



## New Company to Publish Marine Books

A new book publishing and selling firm, the International Marine Publishing Company, has been established in Camden, Maine. The firm will supply books on such subjects as: the fishing industry, oceanography, marine photography, seamanship, and boat building. Where no published book can be provided, the company will attempt to fill the need with its own publications. The books and other products will be sold through normal retail outlets.

Three publications are now in the works--one on the history of dories and how to build them, a photographic appreciation of the Chesapeake Bay oyster industry, and a book on handling small sailing and power boats in heavy weather.



## Fishery Legislation Proposed in Congress

Aware of growing public concern about the depredations of unrestrained technology on the environment, both the President and the Congress have responded constructively.

Executive Action

On May 29, the President established an Environmental Quality Council composed of himself, the Vice President, the Secretaries of Interior, Agriculture, Commerce, Transportation, Health, Education and Welfare, and Housing and Urban Development. At the same time, he established a Citizens' Advisory Committee on Environmental Quality. Its members are persons who have been serving on the now defunct Citizens' Advisory Committee on Recreation and Natural Resources.

The President said:

". . .In our time, technological development threatens the availability of good air and good water, of open space and even quiet neighborhoods. . .the quality of our American environment is threatened today as it has not been threatened before in our history. Each day we receive new evidence of the declining quality of the. . .environment.

"I am asking the Council, with the assistance of the Citizens' Advisory Committee, to examine the full range of variables which affect environmental quality. . .to review existing policies and programs, and to suggest ways of improving them. Its members must project the impact of new technologies and encourage scientific developments which will help us protect our resources.

". . .this new body must anticipate new problems even as it focuses on present ones. It is not enough that it provide answers to the questions we are asking today. It must also pose the new questions which will face us tomorrow."

House Response

More than 25 members of the House of Representatives have introduced bills and resolutions pertaining to environmental quality. They range from a resolution creating the House Committee on the Environment, to a bill that would expand the Department of the Interior and redesignate it the Department of Resources, Environment and Population.

Senate Action

At least 46 Senators have introduced or cosponsored bills and resolutions aimed at preserving environmental quality.

On July 10, the Senate considered and passed S. 1075, a bill to establish a national policy for the environment; to authorize studies, surveys, and research relating to ecological systems, natural resources, and the quality of the human environment; and to establish a Board of Environmental Quality Advisers.

The report of the Committee on Interior and Insular Affairs on S. 1075 states, in part:

"The inadequacy of present knowledge, policies, and institutions is reflected in our Nation's history, in our national attitudes, and in our contemporary life. We see increasing evidence of this inadequacy all around us: critical air and water pollution. . . the degradation of unique ecosystems; needless deforestation; the decline and extinction of fish and wildlife species. . .thermal pollution, and many, many other environmental quality problems.

"As the evidence of environmental decay and degradation mounts, it becomes clearer each day that the Nation cannot continue to pay the price of past abuse. The costs of air and water pollution, poor land-use policies and urban decay can no longer be deferred for payment by future generations. These problems must be faced while they are still of manageable proportions and while alternative solutions are still available.

"One of the major factors contributing to environmental abuse and deterioration is that actions--often actions having irreversible consequences--are undertaken without adequate consideration of, or knowledge about, their impact on the environment. . . .seeks to overcome this limitation by authorizing all agencies of the Federal Government, in conjunction with their existing programs, and authorities, to conduct research, studies, and surveys related to ecological systems and the quality of the environment. (It) also authorizes the agencies to make this information available to the public, to assist State and local governments, and to utilize ecological information in the planning and development of resource-oriented projects."

--Barbara Lundy

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# OCEANOGRAPHY

## Strange Buoys Thrive in Puerto Rican Waters

The crews of vessels passing 20 miles south of Ponce, Puerto Rico, can see "a weird, bright orange bud attached to a yellow stem and protected from sun, wind and rain by a white umbrella." It seems about to bloom.

"We know it's alive because we can hear a good, loud audio tone from its monitor radio transmitter and are getting positioning data on it from a high-flying satellite," reported Bob Kee, a U.S. Naval Oceanographic Office (NOO) oceanographic engineer. He helped develop and plant the exotic blossom in about 5,000 feet of Caribbean water.

Complex Buoy Array

The strange ocean flower is a complex buoy array that contains the Interrogation Recording Location System (IRLS). This system was designed to record and transmit oceanographic data to an interrogating satellite. It is supported in the Caribbean waters by an anchored subsurface buoy and a spar float.

Kee said IRLS now transmits to the satellite only a limited amount of oceanographic data--on wave heights and sea states needed to assess the array's ocean environment. The satellite is the polar-orbiting NIMBUS B II launched last spring by the National Aeronautics and Space Administration (NASA). Also, other instruments beneath the orange bud (which is a radar reflector) tell the satellite--and the scientists who later interrogate its recording and storing mechanisms--that the buoy system is well.

Array's Information

Kee explained: "We are learning how far the array's mast has tilted and how far the mast is from the water's surface as well as the direction in which its antennas are pointing--performance information that we are comparing with weather and general oceanographic data to see how well the system is working in the hostile ocean environment. The array also has instruments aboard to notify the scientists of buoy leaks and mooring cable breaks.

The Future

The present experiment is designed primarily to test IRLS' performance. It is the first phase of an idea conceived by NOO and NASA scientists to determine the possibility of using a satellite to locate and interrogate oceanographic instruments placed on platforms throughout the world's oceans.

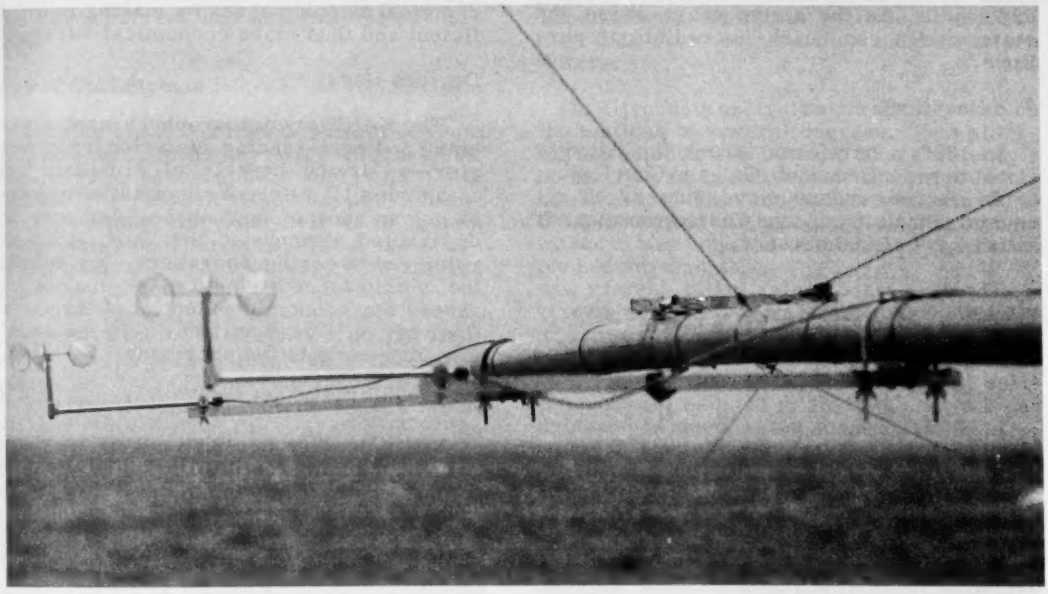
These future platforms may be thousands of IRLS-instrumented buoy arrays. The platforms also may include ships of opportunity--Naval and commercial ships not normally equipped for oceanographic surveying. The scientists already are thinking about developing compact electronic instrument packages designed to take oceanographic measurements. These devices would be installed on the ships that travel both established sea lanes and remote, deep-ocean areas.

## A Step Toward Global Ocean Forecasting System

U.S. Naval Oceanographic Office (NOO) scientists believe they now have equipment to measure wind velocities that are needed to compute "momentum flux." This flux is complex air movements that produce waves by transferring energy across the ocean surface. The equipment is a boom and 2 wind gauges strong enough, when driven into steady Trade Winds, to measure wind velocities.

The equipment was tested about 100 miles north of Barbados in the British West Indies. The results showed that it may now be possible to instal rigging and instruments designed to measure horizontal wind velocities (wind's speed and direction as it blows across the ocean) aboard Navy and commercial ships.

P. S. DeLeonibus, the cruise's chief scientist, said this capability is an important step in developing a world-wide ocean forecasting system. One day this system may operate like the daily U.S. weather-prediction network.



WHIRLING ANEMOMETERS MEASURE WIND--Two of the 4 cup anemometers attached near end of 10-meter boom extending forward from bow of GILLISS. These record horizontal wind velocities for wind-wave specialists. The measurements may help them learn how to compute momentum flux--complex air movements that produce waves by transferring energy across ocean surface.

The Equipment

"The rigging and instruments," he explained, "could be attached to ships stationed in deep ocean areas where the construction of stable platforms designed to support oceanographic and meteorological measuring devices is not possible."

This system would be based on quick computer mathematics obtained from descriptions of ocean and atmospheric conditions--recorded by instruments aboard ships and stable platforms. Forecasts resulting from this network would ensure safety of ships at sea. They also would speed passages and help fishing and mining industries to tap the ocean's riches.

## Storm Surge Studied

Water not wind is the "most deadly and destructive feature of the hurricane," according to U.S. Weather Bureau experts studying coastal floods caused by storm surges along most of the Atlantic and Gulf coasts.

At ESSA's National Hurricane Center in Miami, Fla., weathermen are gathering data on every aspect of these sudden, storm-generated rises of water levels along the shore. The results, already complete for some areas, will enable forecasters to point out specific danger areas when a storm approaches the U.S.

What Storm Surge Is

The height of a storm surge can vary greatly over a relatively short stretch of coastline. This would depend on geographic features and where the storm itself is in relation to the shore. A surge of only a few feet that could flood hundreds of square miles of low-lying delta land at a river's mouth could go practically unnoticed 50 miles up the coast.

The Weather Bureau states that the classical definition of storm surge is the abnormal rise of the sea along the shore, resulting primarily from storm winds and low atmospheric pressure. However, many factors help determine the height the surge will reach as it travels from storm center to coast. Superimposed on the normal astronomical tide and storm tide are heavy, storm-produced waves

and swells. As the storm nears shore, the storm surge can reach "incredible proportions."

The Deadliest

In 1893, a hurricane struck the Atlantic Coast between Savannah, Ga., and Charleston, S. C. A tremendous wave submerged all coastal islands around the Charleston area. It killed 1,200-2,000 persons.

The deadliest disaster in U.S. history was the 1900 Galveston, Tex., hurricane. Nearly 6,000 persons died. Most of them drowned in Gulf waters, which rose as high as 20 feet in a few hours.

In 1957, a storm surge over 13 feet high was created by Hurricane Audrey. It inundated parts of the flat Louisiana coast. In some sections, the surge flooded areas 25 miles inland. The death toll was 390.

The storm-surge data being compiled are available to local officials and civil defense agencies.

The Weather Bureau has practical advice for coastal residents threatened by the hurricane storm surge: If a hurricane "watch" or "warning" is issued, tune in radio or television for the latest advisories and bulletins from the ESSA Weather Bureau. These will include information on expected rises of coastal waters.

## Gulf of Mexico Oceanographic Study Underway

Oceanographers of the U.S. Naval Oceanographic Office (NOO) are conducting an intensive 1-year shipboard probe into the oceanography of the Gulf of Mexico. They are working with geologists from the U.S. Geological Survey (USGS) aboard the USNS KANE to collect oceanographic and geological data from the Gulf. They are seeing much of their geochemical information analyzed almost as soon as they gather it.

To Dr. Charles W. Holmes, a USGS staff geologist, positive results from this combination of data-gathering and data-processing techniques "will be a breakthrough in geochemical mapping at sea by making more efficient and thus more economical surveys."

Devices Used

The KANE's oceanographers-analysts are using a direct-reading emission spectrometer--a device capable of simultaneously measuring 10 different chemical elements--to get an idea of how these elements are distributed throughout the Gulf sediments retrieved in coring operations. By mapping the elements' distribution, geologists can assess the economic potential of large sea-floor areas. The result may help industrialists plan exploitation programs.

Sea-Floor Elements

NOO scientists are particularly interested in understanding the distribution of elements throughout sea-floor sediments. They can use maps and analyses based on these data as guides in predicting ocean-floor geologic changes, which are needed by the Navy and the maritime community.

Survey Aims

The scientists hope the probe will clarify some historical theories on how the Gulf was formed and how it may look in the future. They want to substantiate recent data that point to more oil-producing sands than previously had been determined for offshore Gulf areas. The data also indicate the presence of high concentrations of zirconium, a heavy metal with a high melting point that can be used in alloys.

## Probe Warm Eddy Near Gulf Stream

Oceanographers of the U.S. Naval Oceanographic Office (NOO) hope that analysis of temperature and salinity data collected during a recent scientific cruise in Atlantic coastal waters will help them to learn "how warm water eddies form, develop and sometimes disappear in ocean waters." Al Fisher, the survey's chief scientist, said the eddy study is part of program designed to give oceanographers working as ocean forecasters greater understanding of how temperature conditions in relatively shallow continental shelf waters fluctuate in relation to time and space.

The analyzed results will provide the Navy with wave, current, and temperature predictions.

Edge of Gulf Stream

Working about 75 miles northeast of Cape Hatteras, N.C., near the edge of the Gulf Stream, the oceanographers aboard the USNS GILLISS first pinpointed the eddy and collected their temperature data. It is a warm, highly saline phenomenon. Unlike the nearby warm Gulf Stream waters, it is limited apparently to near-surface waters.

Fisher noted: "Although we do not know exactly how a warm water eddy forms, we believe that this one may be associated with physical conditions, which may result during offshore movement of the Gulf Stream as the strong current passes Cape Hatteras."

Past attempts to locate this eddy were not always successful and the oceanographers believe it may disappear from time to time. Fisher said the eddy has been observed in the past either as "a tongue protruding from the Gulf Stream or as an independent feature."

The GILLISS Operation

As the GILLISS steamed along a grid pattern, across the area containing the eddy, the oceanographers used recording systems to obtain continuous data on water-surface temperature and salinity. They dropped expendable bathythermographs--instruments designed to record temperature as they sink to bottom--at 4-mile intervals along the grid.

The oceanographers examined the relationship between the warm eddy and the surrounding colder waters. At 19 different stations along the ship's route, they stopped the ship to lower instruments that measured continuously temperature and salinity at subsurface depths. These readings gave the scientists an idea of the eddy's structure. The readings will be used, with surface temperature, to draw a 3-dimensional picture of the phenomenon.

Air Support

To help determine the eddy's boundaries, other scientists working aboard a research airplane made remote-sensing flights over the area on 4 of the 10 survey days. Airborne expendable bathythermographs and the plane's radiation thermometer were used. The airborne scientists recorded temperature data from both surface and subsurface waters.

In-flight data analysis showed temperature fluctuations of several degrees. This allowing the scientists to pinpoint where the eddy's boundary was in relation to the surrounding cold waters. This information was relayed to GILLISS scientists, who used it to determine where to take detailed temperature and salinity measurements.

During one 5-hour period, the airborne scientists ordered it flown as low as 200 feet over the ship to compare plane instrumentation with the GILLISS'. Results of the comparison will be used to aid data analysis and to evaluate new plane instrumentation.

Marine Animals Surveyed

Both air and ship oceanographers also look for the types and numbers of marine animals in a survey area because these, like ocean conditions, can hamper transmittal of sound signals during Naval sonar ranging operations.

The scientists reported several whales and hundreds of porpoises.

## U. of Washington Sponsors S. American Oceanographic Tour

The University of Washington is sponsoring a South American study tour in oceanography, Jan. 16-Feb. 8, 1970. The tour will travel by air, sea, and land from San Diego, Calif., to the Galapagos Islands, Punta Arenas, Trinidad and Tobago, and intermediate points of interest.

It will be conducted by University oceanographers and local biologists and geologists for laymen--and offer "on-site observation and study of intertidal and near-shore environments, tropical marine biology, coastal engineering, coral reefs, volcanoes, beaches, and fjords."

For information: University of Washington, Office of Short Courses and Conferences, 327 Lewis Hall, Seattle, Wash. 98105.

## Foreign Fishing Off U.S. in June

Bad weather reduced surveillance in the Northwest Atlantic in June. About 146 foreign fishing and support vessels were sighted, 25% fewer than the 201 sighted in May.

OFF SOUTHERN NEW ENGLAND & GEORGES BANK

Soviet: One hundred and forty vessels--28 factory stern trawlers, 96 medium side trawlers, 6 factory base ships, 9 refrigerated fish transports, and 1 tanker were sighted. (In June 1968, 103 had been sighted.)

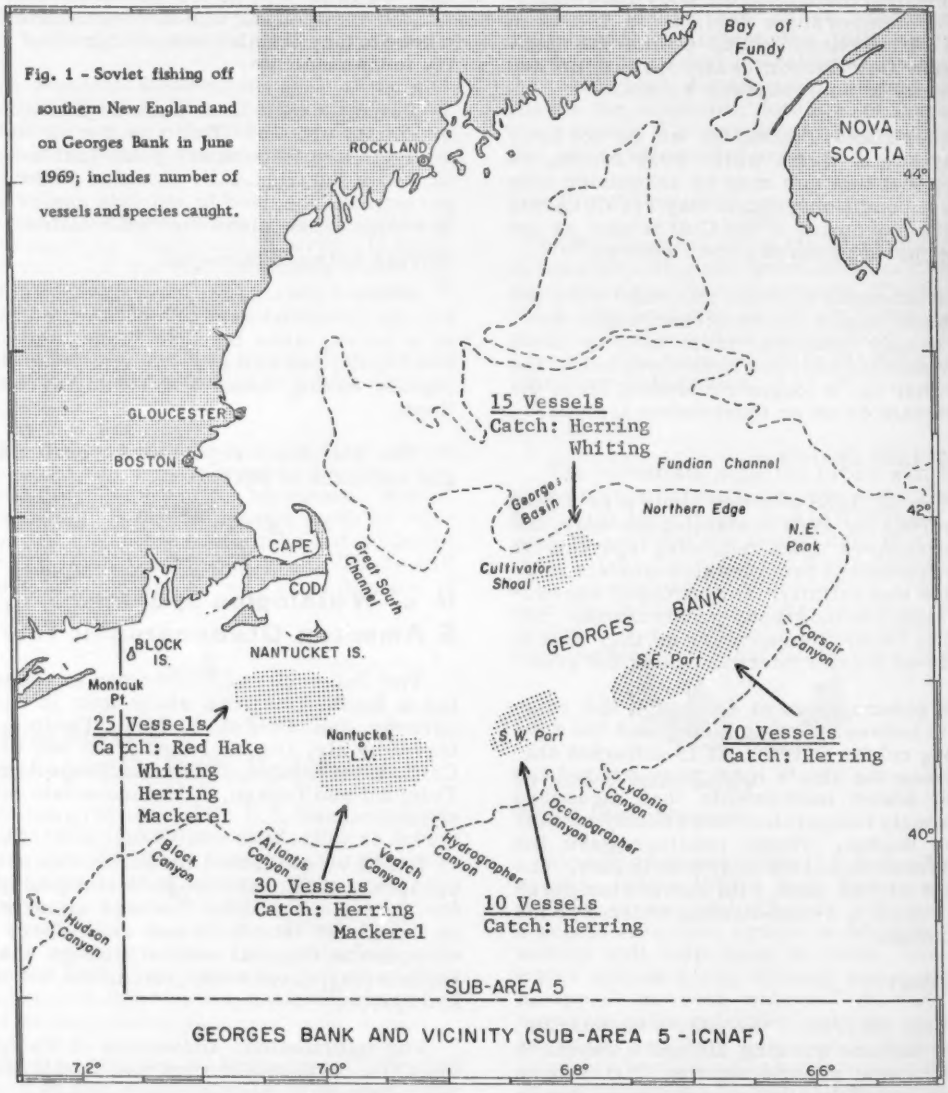



Fig. 1 - Soviet fishing off southern New England and on Georges Bank in June 1969; includes number of vessels and species caught.

Polish: Two stern trawlers and 1 side trawler were sighted.

Bulgarian: The factory stern trawler 'Flamingo' was sighted off southern New England in May, and again in June. Late in June, the stern trawler 'Bekas' joined her about 30 miles south of Martha's Vineyard. Catches reportedly were herring and mackerel.

Fig. 2 - Bulgarian stern freezer trawler 'Flamingo' fishing off New England.

Greek: The trawler 'Paros' had been fishing on Cultivator Shoals, Georges Bank since early May and, by June 23, had caught about 235 metric tons--¼ her 700-ton capacity. Catch was 94 tons of cod, 58 tons of flounder, 27 tons of haddock, 40 tons of herring, scup, and mackerel, and 16 tons of other species.

MID-ATLANTIC, SOUTH ATLANTIC & GULF OF MEXICO

No foreign fishing vessels reported.

OFF PACIFIC NORTHWEST

Soviet: Sixty-five vessels were sighted--31 stern and 10 side trawlers fishing hake, 9 vessels whaling, 3 conducting fishery research, and 12 support vessels. By mid-month, nearly all except the whalers were off south Washington coast. (In June 1968, 83 vessels including 43 stern trawlers had been sighted.)

The whaling fleet was off south Oregon. Ten whales were seen being towed by a factoryship, parts of 4 were on deck, and 8 were buoyed and flagged in vicinity of catcher boats.

Japanese: No vessels sighted. (In June 1968, 3 stern trawlers had been reported.)

OFF ALASKA

Soviet: From 20 to 25 vessels were sighted, about the same as in May 1969 and June 1968.

In the ocean perch fishery, 1 to 3 factory trawlers fished along the 100-fathom curve in the Gulf, and 3 to 12 factory trawlers, 3 medium trawlers, and 1 refrigerated carrier were along the Aleutians.

About 10 trawlers and 1 refrigerated carrier fished pollock, sablefish, arrowtooth flounder, and rockfish northwest of the Pribilofs, off Shelf edge in central Bering Sea. About 2 medium trawlers were northwest of Unimak Pass in eastern Bering Sea.

Japanese: Vessels increased from slightly over 400 in late May to 530 by late June.

In the ocean perch fishery, 2-12 stern trawlers and 1 refrigerated transport fished in the Gulf, 2 to 6 stern trawlers were along Aleutians, and 15-20 independent stern trawlers, and at least 2 refrigerated transports were along Shelf edge in eastern and central Bering Sea.

Five factoryship fleets in the Bering Sea trawl fishery for Alaska pollock and flatfishes to be used for minced fish meal, meat and oil centered on the Shelf edge in the Bering Sea, northeast of the Pribilofs.

By late June, 8 high-seas salmon fleets were in central Bering Sea, 2 were around Attu in western Aleutians, and another was south of western Aleutians, out of Alaskan area.

The Bering Sea herring fishery--2 factoryships, 40 gill-netters, and 2 cargo vessels--ended after first week, when 2 vessels were apprehended for fishing in U.S. contiguous zone.

South Korean: Seven small trawlers, 1 factoryship, and 2 refrigerated transports fished on the Shelf, northeast of the Pribilofs, close to the Japanese minced-fish-meat-and-meal fishery. Catches primarily were Alaska pollock. A larger stern trawler operating independently also fished pollock in the same area.

Late in June, 5 gill-netters and a refrigerated transport began fishing salmon in outer approaches to Bristol Bay, north of Alaska Peninsula. Catches were mature sockeye salmon on their way to Bristol Bay.

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# STATES

## Alaska

### 1964 ALASKAN QUAKE MOVED MOUNTAINS, SHIFTED ISLANDS

The force of the 1964 Alaskan earthquake shifted islands, moved parts of vast mountain ranges horizontally 50 feet, and sank some mountains almost 10 feet. This has been reported by ESSA's Coast and Geodetic Survey.

The Good Friday earthquake was the strongest ever recorded on the North American continent. The seismic sea wave that followed caused 131 deaths and over $750 million damage. Scientists still are assessing the effects.

Book Contains Findings

Some of their findings are reported in the third volume of "The Prince William Sound, Alaska, Earthquake of 1964 and Aftershocks," prepared by the ESSA agency. This volume contains research studies and interpretations in geodesy and photogrammetry.

Among the findings are:

1. The Chugach and Kenai Mountains, about 80 miles from Anchorage in southeastern Alaska, shifted southward about 50 feet.

2. The mountain masses south of Portage subsided 9.84 feet.

3. Three islands in Shelikof Strait--Ushagat, Afognak, and Kodiak--shifted to east and south.

4. Montague Island, at edge of Prince William Sound, the earthquake center, was lifted over 30 feet. This unpopulated island, about 50 miles long and 10 miles wide, was tilted: one side rose more than 10 feet above the other, and shifted its position 40 to 50 feet.

5. The Matanuska Valley settled about 1.6 feet.

6. The earthquake was so strong and followed by so many aftershocks that "the earth's crust was fractured in many different forms throughout the entire region."

7. The ocean floor between Kodiak and Montague Islands rose about 50 feet, the greatest uplift ever recorded. Gravity studies indicated "a massive intrusion of magma" (molten rock from within the earth) caused the uplift.

Findings Based on 1964-68 Surveys

The findings are based on 1964-68 surveys. Scientists emphasized that the findings were relative. No one could be absolutely sure of what happened. But the findings were based on painstaking surveys by geodetic, photogrammetric, and hydrographic field parties.

Charles A. Whitten, the Coast Survey's chief geodesist, analyzed the movement of mountain ranges and islands. He stated: "The resurveys have indicated that the Chugach Mountains (which are south of the Matanuska River), the Kenai Mountains, and the islands in Prince William Sound have all shifted to the south."

He added that the shift began "with a slight elongation across the Matanuska Valley, accumulating to a maximum of the order of 15 meters (50 feet) for the southeastern slopes of the Kenai Mountains, Montague Island, and the nearby regions extending into the Gulf of Alaska."

Whitten continued: "Repeat surveys made in 1967 across Shelikof Strait show that Ushagat Island, Afognak Island, and Kodiak Island have been displaced to the east and south with a direction that is fully related to the displacement of the Kenai Mountains."

He said the maximum movement occurred between Homer Spit and the south side of the Kenai Mountains, a distance of less than 50 miles.

Other findings:

1. The maximum earth subsidence from Glennallen towards Fairbanks was 7 feet. In the Alaska Range along the Richardson Highway, an upheaval of .3 to .8 foot occurred.

2. From Matanuska to 15 miles southeast of Fairbanks, maximum subsidence was 1.9 feet.


Vast mountain ranges moved 50 feet, some mountains sank 10 feet into the earth, and islands were shifted by force of 1964 Alaskan earthquake, according to new findings of tremor's effect recently made public. Drawing depicts area hit hardest by strongest earthquake ever recorded on North American continent.

3. In general, subsidence from Seward to Anchorage ranged from 2.3 to 6.2 feet. From Anchorage to Matanuska to Glennallen, the subsidence ranged from .167 foot to 5.1 feet.

The new earthquake volume can be purchased from Government Printing Office, Washington, D. C. 20402, for $4.25.

* * *

SEA LIONS OBSERVED ON AN ALEUTIAN ISLAND

Two BCF scientists observed Steller sea lion rookeries on Ugamak Island in the Aleutians from June 3-21. Ugamak, on the southwest approach to Unimak Pass, is part of the Aleutian National Wildlife Refuge. The rookeries are heavily populated in June, when the pups are born. The scientists estimated that there were more than 15,000 sea lions around the island. Storms cause a substantial loss of pups from rookeries on steep beaches.

Prepare for Future Study

The scientists also established counting and photographic stations, and access routes to rookeries, in preparation for a proposed future sea-lion population and behavior study.

## California

FASTER ANCHOVY AGE ANALYSIS DEVELOPED

New procedures for age analysis of anchovies have been established by scientists of the California Department of Fish and Game and BCF.

Otoliths to be Used

Otoliths and scales are equally usable for anchovy age determination. Otoliths will be used because they are available from all fish, while scales often are missing from a high percentage. The time required to clean and mount scales between glass slides also will be saved because otoliths are read without mounting. The samples collected during each quarter of a year will be divided equally among 4 readers; quarterly summaries will be compiled.

Check Systems Devised

Routinely, each pair of otoliths will be read only once. But, to insure that all 4 readers continue to read alike and to detect changes in reader accuracy, 2 check systems have been devised. During a quarter, each reader will receive at least one sample read by another to compare their readings. The second test will be a standard set of otoliths covering all age-classes on which all readers have agreed. Periodically, this standard set, labeled like a routine sample, will be sent to each reader.

* * *

CATFISH FARMS IN IMPERIAL VALLEY AROUSE INTEREST

The establishment of Imperial Enterprises with about 300 acres of catfish ponds has created considerable interest in California's Imperial Valley. About 380 acres are under production and 500 more are planned. Almost ideal conditions exist in water, soil, and temperatures. Until now, most sales have been to catch-out ponds, but interest is developing in restaurant and market outlets.

## Massachusetts

GLOUCESTER-BASED SHRIMP FISHERY IS DEVELOPING

A new shrimp fishery based in Gloucester, Mass., may develop into a year-round operation. There are now 7 vessels in the fishery. Trucks haul the catch from Gloucester to Boothbay Harbor, Maine, for processing. However, a shrimp plant is expected to be opened in Gloucester within a few months.

Shrimping Good

The fishing has been surprisingly good. Several vessels have landed 15,000 pounds from 1- to 2-day trips. New England shrimp fishing has been mainly a winter operation, primarily out of Portland, Maine.

## Oregon

### PORTS CLOSED TO CALIFORNIA-CAUGHT SHRIMP

On August 5, the Oregon Fish Commission closed Oregon ports to landings of pink shrimp caught off California. The California Department of Fish and Game had closed California ports earlier.

The small pink shrimp, widely used in seafood cocktails, are harvested from large beds off Washington, Oregon, and California. The California bed is limited in size and intensively managed. California Department of Fish and Game biologists set a quota annually for the harvest. When the quota is reached, the bed is closed to further fishing, leaving a brood stock to replenish the bed. The 1969 quota of 3 million pounds was expected to be reached on August 2.

The Oregon Fish Commission action only prohibits landings of shrimp caught south of the Oregon-California border. It does not apply to shrimp taken off Oregon.

## Texas

### ADVICE FOR STOCKING FARM PONDS

New farm ponds should not be dumps for any kind of fish, asserts Fred G. Lowman, supervisor of freshwater fisheries in Waco for the Texas Parks and Wildlife Department. Special attention should be given to species and numbers. New impoundments should be stocked with the kinds of fish the owner or operator wants to catch or use.

It is very important to restrict the number to what the water will be able to support. Lowman emphasizes that it would be futile to place balck bass in a farm pond if no one in the area fished these. The same is true of other species.

### Catfish Before Black Bass

When bass and channel catfish are going to be put in a stock tank, the best results may be expected when the catfish are introduced in the fall--before releasing the black bass the following spring. Bass stocked in farm ponds in the spring often grow large enough by fall to consume most catfish, or other fish stocked at the same time.

Lowman says people hurt their chances for good fishing when they release fish of varying sizes and species.

* * *

### PORT OF HARLINGEN FISH KILL DUE TO PROLONGED POLLUTION

The recent estimated kill of 5 million fish in the Arroyo Colorado and the Port of Harlingen was due to a "natural" form of pollution, report biologists of the Texas Parks and Wildlife Department. They explain that hydrogen sulfide, created by decaying organic matter, settles to the bottom and accumulates until the water is disturbed. Low tides and the disturbance caused by propellers of boats and ships caused this gas to circulate through the water and kill fish.

Of the 5 million, over 99% were menhaden, the remainder small noncommercial fish.

ARTICLES

# GROUNDFISH SURVEY PROGRAM OF BCF WOODS HOLE

Marvin D. Grosslein

Otter trawl surveys of groundfish populations in New England waters have been conducted from time to time over the last 20 years by BCF's Biological Laboratory at Woods Hole, Massachusetts. The frequency and scope of these surveys increased markedly after acquisition of the new research vessel 'Albatross IV' in 1963. Nine surveys in 1963-65 represented 3 seasons each year and covered the Continental Shelf out to a depth of 360 meters (200 fathoms), from Long Island to western Nova Scotia. This was about 60,000 square miles. In 1967, the survey area was extended south to Cape Hatteras, N. C., in response to increasing concern over foreign exploitation of the stocks of fish in the Middle Atlantic Bight (Fig. 1). The total survey area now covers nearly 75,000 square miles. It is being covered twice a year, one cruise each spring and fall.

Principal objectives of the survey program are:

1. To monitor fluctuations in structure and size of fish populations--to provide a measure of the effects of fishing that is independent of commercial fishery statistics.

2. To assess the fish production potential of Atlantic coastal waters.

3. To determine environmental factors controlling fish distribution and abundance.

4. To provide basic ecological data on fishes (e.g., growth rates and food) necessary to understand interrelationships between fish and their environment.

## METHODS

### Routine Data Collected

Routine data recorded for each survey trawl haul include length frequency and total weight of every fish species in the catch--and invertebrates such as lobsters, shrimp, scallops, and squid. Scales or otoliths are also collected routinely for several important groundfish species to estimate age composition, and from this information, mortality rates. Water temperature profiles from surface to bottom are taken routinely throughout the region. Since 1968, fish eggs and larvae have been sampled with plankton nets down to 50 meters simultaneously with otter-trawl hauls. A wide variety of other kinds of data is also collected. This depends on available personnel and needs of individual investigators within and outside BCF.

### Machine Processing Methods Developed

So far, only preliminary analysis of part of the survey data has been possible. The minimum routine information collected on a single cruise represents a formidable quantity of data, and comprehensive analysis requires automatic data processing (ADP) methods. Development of ADP capability at the Woods Hole Laboratory has now reached a point where, for the first time, it is feasible to begin an adequate analysis of the basic survey data--past and present.

### Sampling Design Tailored to Objectives

One prerequisite for successful monitoring of changes in fish abundance is an objective measure of the precision of the abundance index: that is, the sampling error of the average catch per haul of the research trawl. This requirement, plus consideration of the nature of groundfish distribution, led us to adopt a stratified random sampling design for the surveys. The entire area from Cape Hatteras to western Nova Scotia is now subdivided into 58 sampling strata; their boundaries were selected chiefly on the basis of depth--which is known to be correlated with groundfish distribution (Fig. 2). Trawl stations are

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Note: Figs. 5, 7, 8, 9, and 10 are in the appendix in reprint (Sep. No. 846) of this article. For a free copy of the Separate, write to Division of Publications, U.S. Department of the Interior, Fish and Wildlife Service, BCF, 1801 N. Moore St., Arlington, Va. 22209.

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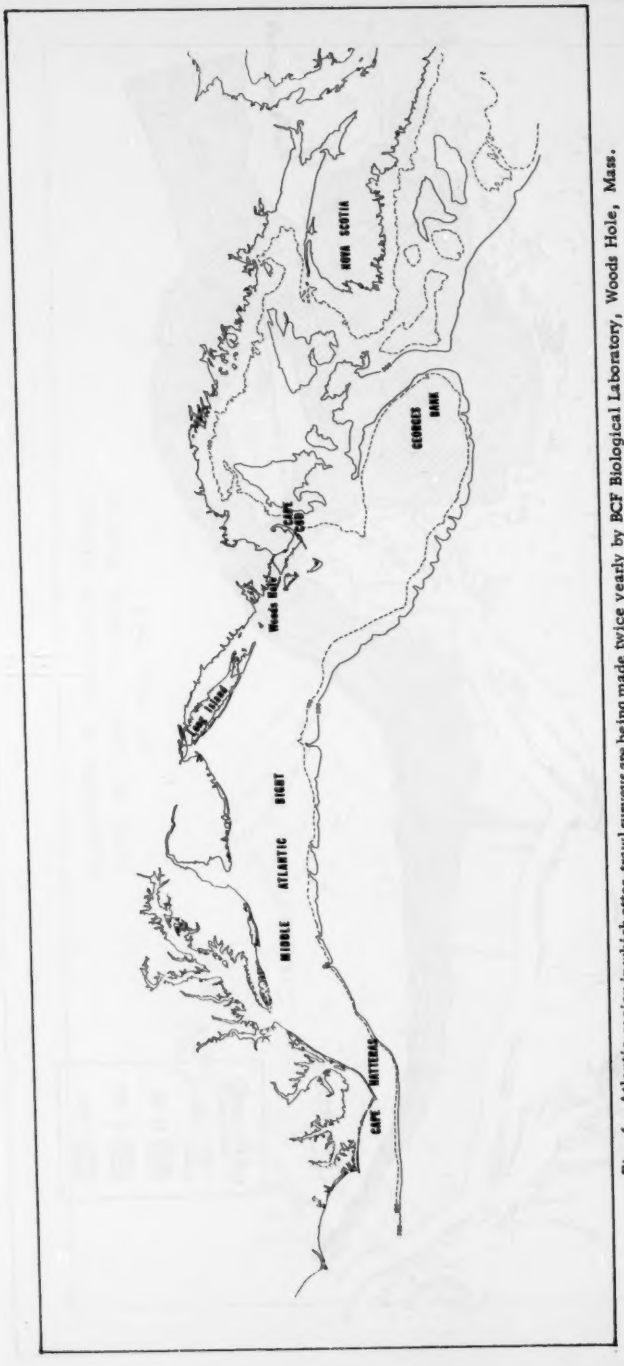


Fig. 1 - Atlantic region in which otter-trawl surveys are being made twice yearly by BCF Biological Laboratory, Woods Hole, Mass.

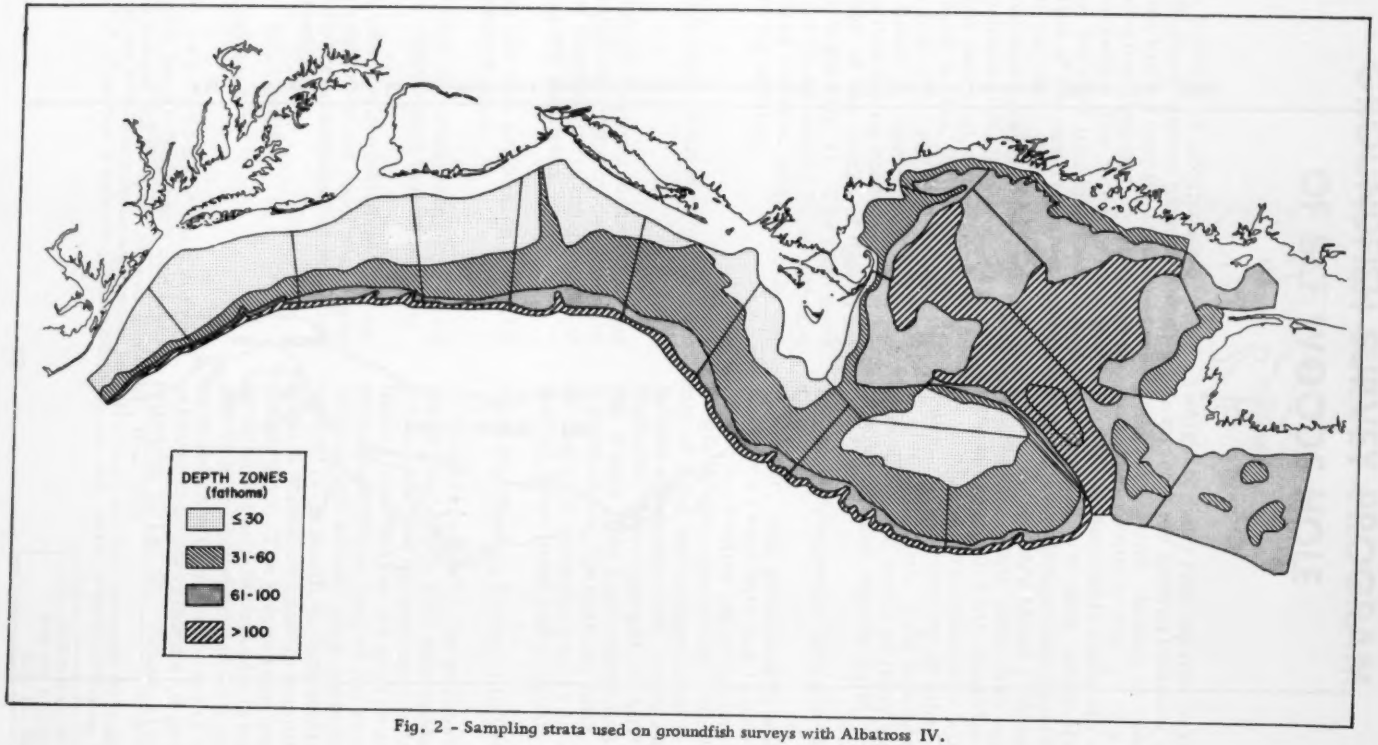


Fig. 2 - Sampling strata used on groundfish surveys with Albatross IV.

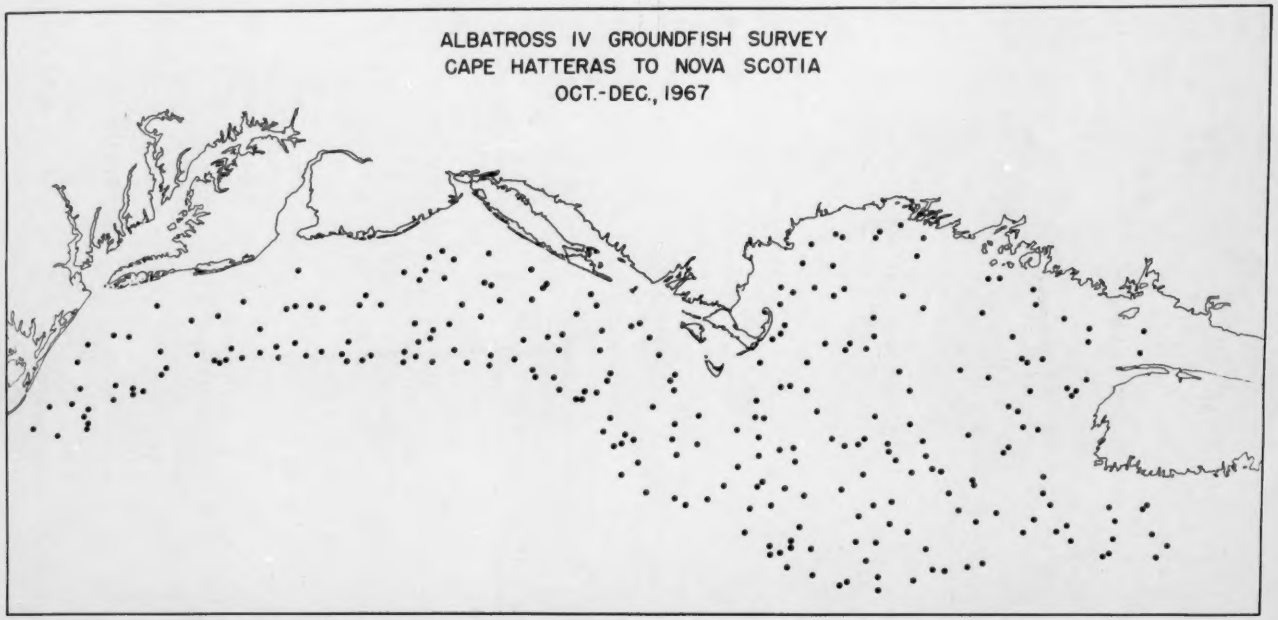


Fig. 3 - Pattern of 272 otter trawl stations occupied by Albatross IV on 1967 fall groundfish survey.

randomly located within each sampling stratum. A typical station pattern is shown in Fig. 3.

This sampling scheme provides fairly uniform distribution of stations throughout the survey region and insures some trawling in every depth zone in all geographic subdivisions. At the same time, random sampling within each stratum obtains valid estimates of the sampling error variance of the abundance indices. The indices are unbiased (representative of the stratum) in the sense that every habitat type is sampled with probability proportional to the area covered by the habitat within each stratum. Preliminary analysis indicates that, with our present design and sampling intensity, the statistical confidence intervals around our abundance indices are sufficiently small to provide a new capability in monitoring fluctuations in groundfish stocks.

Advantages of Research Vessel Data

Relative abundance indices should have small sampling error; it is even more important that they reflect faithfully changes in true abundance of the fish population. Commercial fishing practices change in response to market demand as well as fish availability. And availability from a commercial standpoint may be more closely related to the degree of aggregation of fish than to the absolute abundance. In addition, technological improvements in commercial trawls and fish detection gear occur from time to time. These increase fishing power in a manner very difficult to measure. Research vessel abundance indices are free of these biases because they are based on a standardized fishing method (30-minute haul with a standard survey trawl) and because trawling is done at randomly preselected locations.

Other important advantages of research vessel surveys are synoptic coverage and completeness of catch records. The statistics of commercial landings reflect only those species and size groups suitable for market in a particular port at a particular season. Within any one season, a fleet usually concentrates its effort in a relatively restricted portion of its annual range, depending upon aggregation of the principal species sought. On the other hand, research vessel catches provide information on distribution and abundance of all kinds and sizes of fish available to the trawl over the entire shelf, from Cape Hatteras to western Nova Scotia, within a period of 6-8 weeks.

Rapid and complete coverage of the survey area at specific seasons of the year, as well as over a period of years, is necessary if we are to make real advances in understanding the magnitude and causes of fish movements. It is equally important to monitor the general structure or species composition of the groundfish community. Replacement of heavily exploited desirable species by their unexploited competitors is a possibility that must be considered in any rational long-term management plan. Our surveys are providing "ecological benchmarks" against which future changes in the fish community can be compared.

Distribution and abundance of juvenile fish are other important kinds of information obtained from surveys. Small fish are retained by a fine-mesh liner in our survey trawl. The data on precommercial sizes are necessary to study recruitment; they are useful for making short-term predictions of future abundance. These predictions are rapidly becoming essential as we enter an era of management of international fisheries by national catch quotas.

Trawl Efficiency--A Critical Problem

Trawl efficiency, the ability to catch desired species in desired quantities, imposes the principal problem in interpreting research trawl catches. Ideally, we would like the research trawl to catch all organisms within a specified range of size, in some known proportion to their absolute numbers under a unit area of sea surface. This would give a direct estimate of an identifiable segment of total biomass. Of course, this is not possible. At present, we must settle for some unknown proportion (varying widely for different species) of organisms present in the path of a trawl, the opening of which extends only a few meters above the sea bed. To convert such trawl catch data into estimates of biomass, a great deal more must be learned about factors that determine catching power. These are:

1. Actual distribution of fish in 3 dimensions.
2. Behavior of fish in front of the trawl.
3. Performance of the trawl itself: its configuration and motion relative to the bottom.

Direct measurement of these factors will require remote sensing devices. In particular,

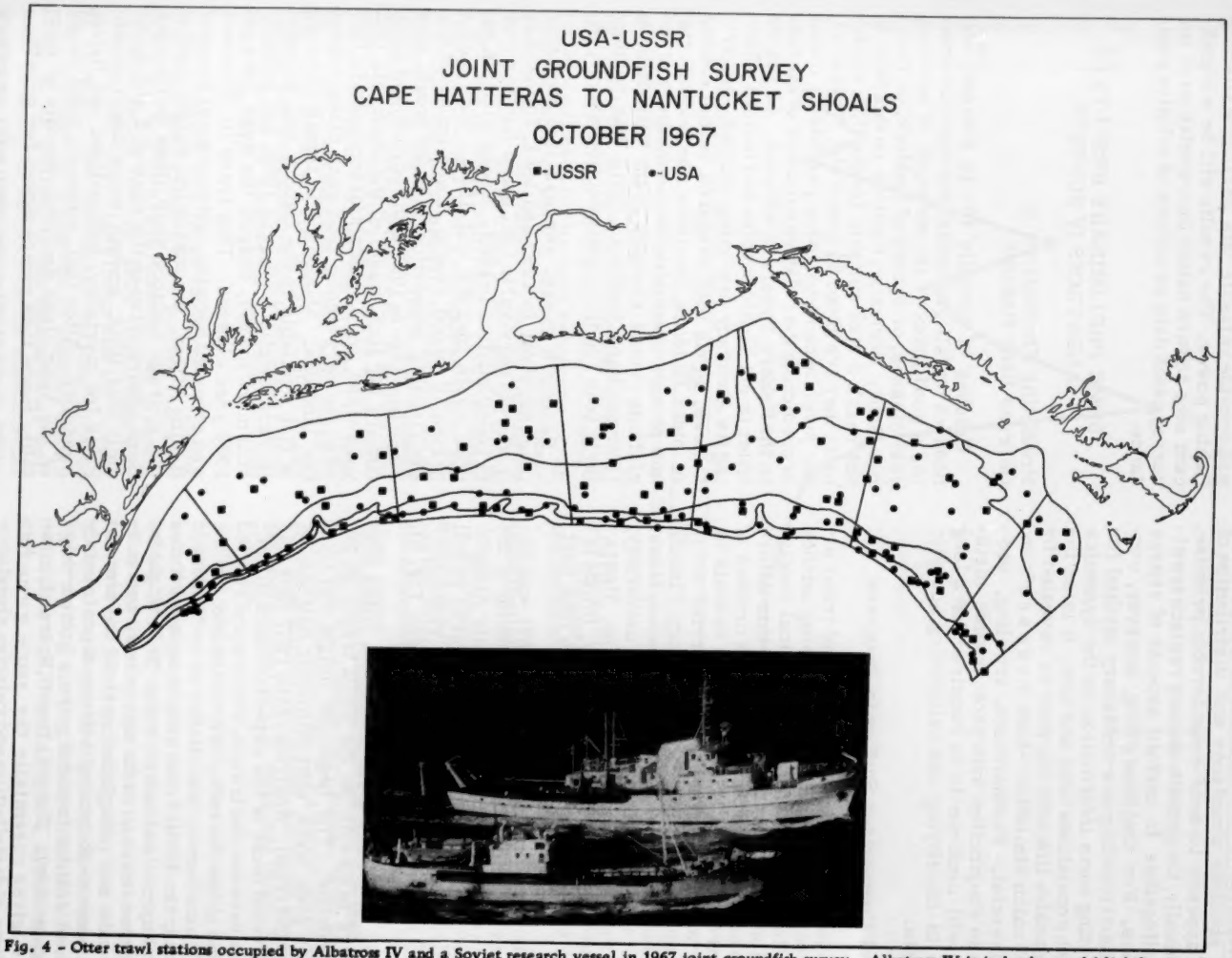


Fig. 4 - Otter trawl stations occupied by Albatross IV and a Soviet research vessel in 1967 joint groundfish survey. Albatross IV is in background (slightly ahead).

development of acoustic methods for assessing absolute abundance and distribution of fish appears to hold considerable promise. Eventually, these methods may replace trawling altogether in certain aspects of census studies. For the time being, however, conventional trawling is a necessary method for providing some information on the dynamics of fish populations here and now. It is an indispensable link with the past as revealed by trawl catch statistics--both research and commercial. Furthermore, trawling, perhaps in conjunction with photographic methods, will continue to be required for a long time in identifying and calibrating acoustic targets.

### Trawl Comparison Studies in Progress

Some insight into the problem of trawl efficiency can be obtained by comparing catches of different trawls for which physical configurations are known. Studies of this nature were conducted as part of the joint cruises of Albatross IV and USSR research vessels in 1967 and 1968. These were carried out in cooperation with BCF's Exploratory Fishing and Gear Research Base at Gloucester, Mass. (Fig. 4). Biologists from state, university, and Federal laboratories in Maine, Massachusetts, New York, New Jersey, Rhode Island, Maryland, and Virginia also took part.

The first cruise (October 1967) was designed to improve our understanding of the dynamics of fish stocks in the Middle Atlantic Bight. The same area was covered in fall 1968; then it was extended to the remainder of the Albatross IV survey area (see Fig. 2).

The U.S. survey trawl was fitted with rollers (absent on the USSR trawl) on the groundrope. The headrope height and total mouth area were approximately half that of the USSR trawl. Analysis of the 1967 data has confirmed most of the expected catch differences between the trawls, which were related to the above factors. For example, on the 1967 joint survey from Hatteras to Nantucket shoals, the USSR trawl caught several times as many red and silver hake. This might be expected because of its higher headrope (silver hake are often found well off the bottom) and because it tended bottom more closely without rollers (red hake are a bottom-hugging species). The smaller U.S. trawl, however, gives essentially the same general picture of distribution and relative abundance (Fig. 5 in appendix). The final results of these joint studies, which are still being analyzed, will provide valuable data on factors affecting fishing power. The results will be a significant step toward better interpretation of our survey catch data as indices of relative abundance.

## SOME PRELIMINARY RESULTS OF ALBATROSS IV SURVEYS

### Predicting Fluctuations of Georges Bank Haddock

Catches of juvenile (6- to 8-month-old) haddock on fall groundfish surveys are proving a good index of the strength of incoming year classes, or broods of haddock, on Georges Bank. Normally, haddock on this bank do not reach a size suitable for the U.S. market until they are about $2\frac{1}{2}$ years old. Therefore, the juvenile haddock index provides a means of predicting the relative numbers of recruits to the fishery 2 years in advance. As yet, the index is not highly precise and factors affecting its accuracy are being studied. Nevertheless, along with research vessel catches of older haddock, the index for juvenile fish has proved invaluable in predicting and explaining recent changes in the abundance of Georges Bank haddock. This was particularly true for the drastic decline since 1965.

Research vessel surveys indicated very poor survival in 1960 and 1961, followed by moderate survival in 1962 and a bumper crop of young haddock in 1963. Brood success was poor again in 1964 and 1965. With such a series of brood years, it was expected that the fishable population (age 2+) would show some increase in 1964 with recruitment to the fishery ($4\frac{1}{2}$ inch mesh) of the moderate 1962 year class, and a substantial increase in 1965 when the very strong 1963 year class entered the landings. Abundance in terms of weight of fish available to the fishery was expected to increase still further in 1966, and possibly still more in 1967, despite the weak 1964 and 1965 year classes. This trend in abundance was expected because, under normal levels of fishing effort, the maximum weight yield of the average haddock year class on Georges Bank occurs between the ages of 3 and 4. Up until that time, growth more than compensates for mortality, both natural and fishing mortality. After that, however, total weight of the year class declines steadily as mortality more than compensates for growth.

The expected increases in total abundance for 1964 and 1965 occurred as shown in fig. 6.

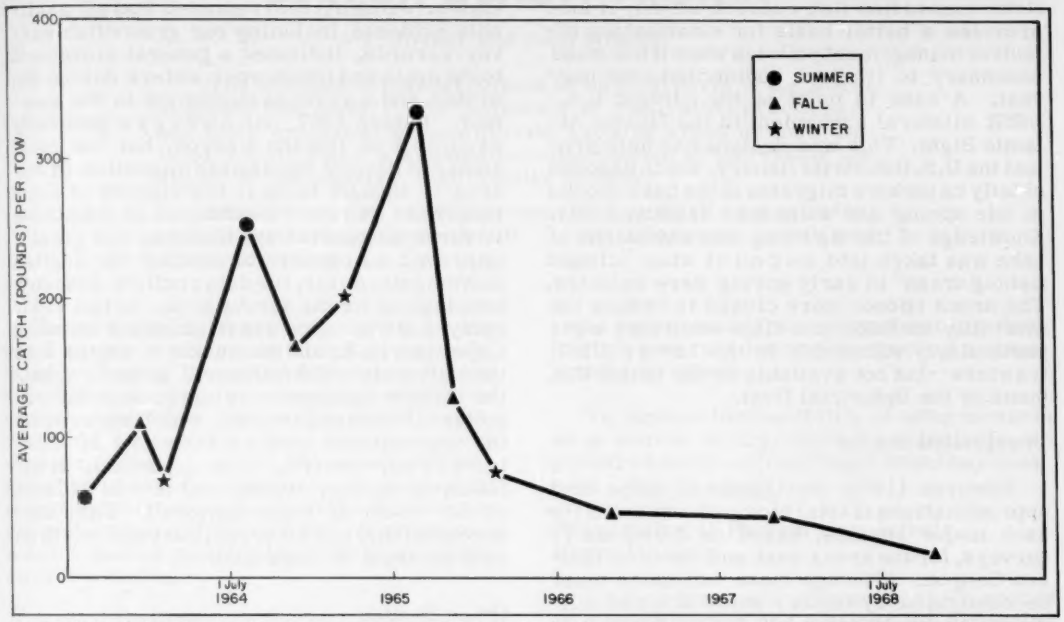


Fig 6 - Haddock abundance indices (average catch per 30 minute haul with standard survey trawl) for Georges Bank from Albatross IV groundfish surveys.

Age analysis showed the increase to be due principally to the 1963 year class. The expected increases for the next two years never materialized for the U.S. haddock fleet, however, because of extremely heavy fishing by foreign fleets on Georges Bank haddock in the latter half of 1965 and in 1966. Total landings in each of those 2 years were about triple the previous long-term annual average, and large numbers of the 1962 and 1963 year classes undoubtedly were removed. A substantial proportion of the 1963 year class apparently was removed in 1965 and the first half of 1966 before full recruitment of that year class to the U.S. fishery. The effects of such heavy fishing are reflected in the precipitous drop in Albatross IV abundance indices early in 1966 (Fig. 6).

In addition to a large increase in fishing mortality generated by the sudden increase in fishing by foreign vessels, the juvenile haddock index for the 1966 year class was low: the 1967 year class index was the lowest on record. The inevitable serious decline was reflected in Albatross IV indices shown in fig. 6. Of course, it has appeared as well in the scarcity of haddock to the commercial trawlers. The 1968 juvenile haddock index also was very low. Therefore, the earliest possible improvement in haddock abundance on Georges Bank is in 1971. It will depend on the success of the 1969 spawning.

## Distribution and Seasonal Movements

Surveys on the scale of the Albatross IV series are particularly valuable in determining the relation between fish distribution and environmental factors. The reason is that they cover a large area within a short time and neither the environment nor the fish distribution will change very much. With proper spacing, surveys can measure efficiently seasonal migrations which, for most species, are correlated with seasonal temperature changes.

Red and silver hake, for example, are in shoal waters during summer and autumn when bottom temperatures are high (maximum in autumn). They move off the shoals into deeper water during the winter, presumably in response to winter cooling; they are concentrated along the shelf edge in deeper, warmer water during spring, when shoal water temperatures are lowest (Figs. 7, 8, 9, in appendix).

Improved knowledge of distribution and seasonal movements makes it easier for

fishermen to find fish concentrations; it also provides a better basis for establishing effective management policies when it becomes necessary to limit or redistribute the harvest. A case in point is the current U.S.-USSR bilateral agreement in the Middle Atlantic Bight. This was designed to help protect the U.S. industrial fishery, which depends chiefly on inshore migrants of the hake stocks in late spring and summer (Lundy, 1969). Knowledge of the spring concentrations of hake was taken into account when "closed fishing areas" in early spring were selected. The areas chosen were closed to reduce the mortality of hake at a time when they were particularly vulnerable to the large USSR trawlers--but not available to the small U.S. boats of the industrial fleet.

## Unexploited Stocks

Edwards (1968) has reported some first approximations of total biomass estimates for each major species, based on Albatross IV surveys, for the areas east and north of Hudson Canyon. Although these estimates must be confirmed by further study of trawl efficiency, they have served to focus attention on certain abundant species that so far have not been exploited.

For example, the largest single unexploited resource is the spiny dogfish, which has long been a nuisance to most U.S. fishermen. Since the dogfish is caught and sold for food in the eastern north Atlantic, the population off our coast very likely will be harvested in the near future.

Spiny dogfish migrate seasonally, but the nature of these movements is not yet well known. Jensen (1969) reported that all available evidence, including our groundfish survey records, indicated a general movement to the south and into deeper waters during the winter, and a reverse movement in the summer. Before 1967, our surveys generally stopped at Hudson Canyon, but the usual southern limit of the dogfish migration in our area is thought to be in the vicinity of Cape Hatteras. The recent extension of Albatross IV surveys south to Cape Hatteras has greatly improved our capacity to monitor the dogfish movements; so far, the data confirm Jensen's conclusions for the survey area. In fall 1967, spiny dogfish were most abundant between Cape May, N. J., and Nantucket in depths less than 100 meters (55 fathoms). In that region, the largest catches were made near the 30-meter (15-fathom) isobath, which represents the approximate inshore boundary of Albatross IV surveys (Fig. 10 in appendix). In the following spring, dogfish had moved at least as far south as Cape Hatteras. They also moved offshore in all areas, east and north as well as south of Cape Cod.

## Other Studies

Details of the studies mentioned above and many others will be forthcoming in the next few years in papers by BCF biologists. The groundfish surveys also are providing valuable data for many non-BCF scientists. In particular, there are current investigations by state biologists, graduate students, and others on various phases of the ecology of several species of hake, squid, flounders, dogfish, crabs, butterfish, skates, and sea robins.

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# MUSSELS: A POTENTIAL SOURCE OF HIGH-QUALITY PROTEIN

T. Joyner and John Spinelli

The success of mussel culture in several parts of the world suggests that further mechanization of cultivation practices--and their extension to appropriate growing areas not now utilized--could make a substantial contribution to increasing the supply of inexpensive, high-quality protein.

Mussels can be readily processed into dried concentrates, rich in protein, with desirable flavor, odor, and nutritional characteristics.

The exponentially growing deficit in the world supply of protein has been widely publicized. Among the proposals for reducing this deficit, the one for converting unutilized marine organisms into a dry, protein-rich, powdered concentrate has attracted much attention. The Bureau of Commercial Fisheries has undertaken extensive technological research into the development of a system for the conversion of fish into FPC (fish protein concentrate) of good quality with a promising market potential.

A viable protein-concentrate industry will require the use of a number of different species as sources of raw material. FPC of high quality has been produced from hake, as well as from oily species such as menhaden, herring, and anchovy. The need for high-quality marine protein for both human and animal use dictates a continuing search for suitable raw materials.

In any assessment of other marine sources of protein, mussels appear very promising. Their wide distribution, fecundity, rate of growth and growth density already have been adapted to highly successful culture systems in many parts of the world. The bulk of the world's commercial mussel harvest is sold fresh, in the shell. Development of markets for significant additional production will require close attention to development of suitable preservation and storage techniques--as well as to the stimulation of new markets for preserved and processed mussel products. If a dried concentrate, rich in protein, could be produced from mussels at low cost, it might generate market interest as a nutritional ingredient.

To explore the feasibility of using mussels as a source of dry, protein concentrate, we prepared samples from Puget Sound bay mussels (Mytilus edulis).

## Preparation of Protein Concentrate From Mussels

Meats were removed from the shell, ground in a food chopper, and steamed for 5 minutes at a pressure of 5 lbs. After being steamed, the meats were extracted twice with hot isopropanol (80° C.) at a ratio of 2 parts solvent to 1 part meat. The extracted meats were then dried in a vacuum at 80° C. for 6 hours. The dried product was milled and screened to separate the protein from the byssal threads (holdfasts) that had remained with the meats.

A 13.5-percent yield (based on the weight of wet meats; 6.75% based on total weight of the mussels) of light-tan-colored concentrate was obtained by this process. Various opinions were expressed by a panel of tasters. Clam-like flavor, lobster-like flavor, hydrolyzed protein flavor and odor, and seaweed color were some of the descriptive terms used by the panelists. Subsequent work has shown that these qualities can be controlled by varying the extraction process. For example, washing the protein with acid in the presence of sodium hexametaphosphate prior

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to extraction with isopropanol produced a product with only slight odor and flavor. Other work has shown that the protein can be extracted more easily by grinding the mussels whole. The resulting slurry is steamed, dried, and then crude milled. The protein can then be separated readily from the shell by air classification.

## Nutritional Evaluation and Chemical Analysis

To evaluate the nutritional and chemical characteristics of mussel protein concentrate (MPC), samples produced by isopropanol extraction of steamed mussel meats were analyzed for proximate composition, minerals, and protein efficiency ratio (PER). Table 1 shows the results of these analyses.

Table 1 - Nutritional Evaluation and Chemical Composition of Mussel Protein Concentrate

| Test or Component | Test Value or Concentration |
|---|---|
| PER | 3.6[1/] |
| Protein | 70.0 percent |
| Ash | 12.0 percent |
| Lipid | 0.2 percent |
| Carbohydrate (glycogen) | 15.0 percent |
| Fluoride | <5 p.p.m. |

1/Casein equal to 3.0.

MPC is readily dispersible in water--a characteristic probably related to its high content of glycogen.

## Requirements for Production of MPC

From the standpoint of a potential processor of protein concentrate, the primary considerations--other than costs--underlying the desirability of a raw material are:

1. reliability of supply
2. ease of processing
3. quality (as reflected in the final product).

The first of these is strongly suggested for mussels by their successful commercial culture in Spain, Holland, France, Denmark, Italy, and Germany; and by recent successful experiments with off-bottom culture in Scotland, the Philippines, Venezuela, and Chile (Table 2). In a preliminary way, the last two characteristics have been demonstrated for the MPC sample prepared by BCF's Seattle Technological Laboratory.

Table 2 - Annual Mussel Production

| | Development of Growing and Harvesting Systems[1/] | Weight in 1,000's of Short Tons (Live)[2/] | | |
|---|---|---|---|---|
| | | e | f | g |
| Chile | b, c | 17.4-32.7 | | |
| Denmark | a | 12.4-21.1 | 51.5 | 21.1 |
| France | a | 28.6-41.2 | | 33.0 |
| Germany (Fed. Rep.) | a | 5.3-12.6 | | 12.6 |
| Italy | a | 13.3-23.0 | | 13.3 |
| Netherlands | a | 93.9-127.4 | | 101.6 |
| Philippines | a, c | | 2.2 | |
| Spain | a | 40.4-72.9 | 165 | 154 |
| U.K. | a, c | 3.2-5.3 | | 4.1 |
| U.S. | d | 1.0-2.8 | | |

1/ a Harvest predominantly cultured mussels
b mussel harvest principally from natural beds
c mussel culture conducted experimentally
d mussel culture absent.

2/ e FAO yearbook of Fishery Statistics (1967). 1961-67 statistics
f Ryther and Bardach (1968)
g Andreu, B. (1968)

When the practices of mussel culture in other parts of the world are considered as possible models for systems to produce the bulk needed for economic production of protein concentrate, the example of Spain is most encouraging. In two decades, from an historically insignificant status, the development of suspended culture has transformed the Spanish mussel fishery into the world's largest. In the deep Galician bays, rafts produce on the average 55 short tons of mussels per year (Andreu, 1968). The average size of a raft is reported by Ryther and Bardach (1968) to be 20 x 20 meters (4,300 square feet approximately 0.1 acre).

The total production in 1968 of six Galician rías (Fig. 1) was estimated at 154,000 short tons (Andreu, 1968). These drowned valleys occur within a 100-mile stretch of coastline facing the Atlantic. One of them, the Riá de Arosa, is a bay 20 miles in length and 89 square miles in area. There are 1,800 rafts covering but a small fraction of the total area. Estimated production for 1968 was 90,000 tons of mussels. Based on 6.5% yield of protein concentrate from whole mussel, this would be more than sufficient for a plant with an annual output of 5,000 tons of protein concentrate--enough to provide 12 grams per person, daily, for 1 million people.

## Potential for Mussel Growing in U.S.

Whether culture systems in United States waters can be developed to approach the level of mussel production in Spain's Galician bays is not yet known. Fishery agencies in Scotland, Chile, and Venezuela have undertaken to adapt Spanish techniques to their waters.

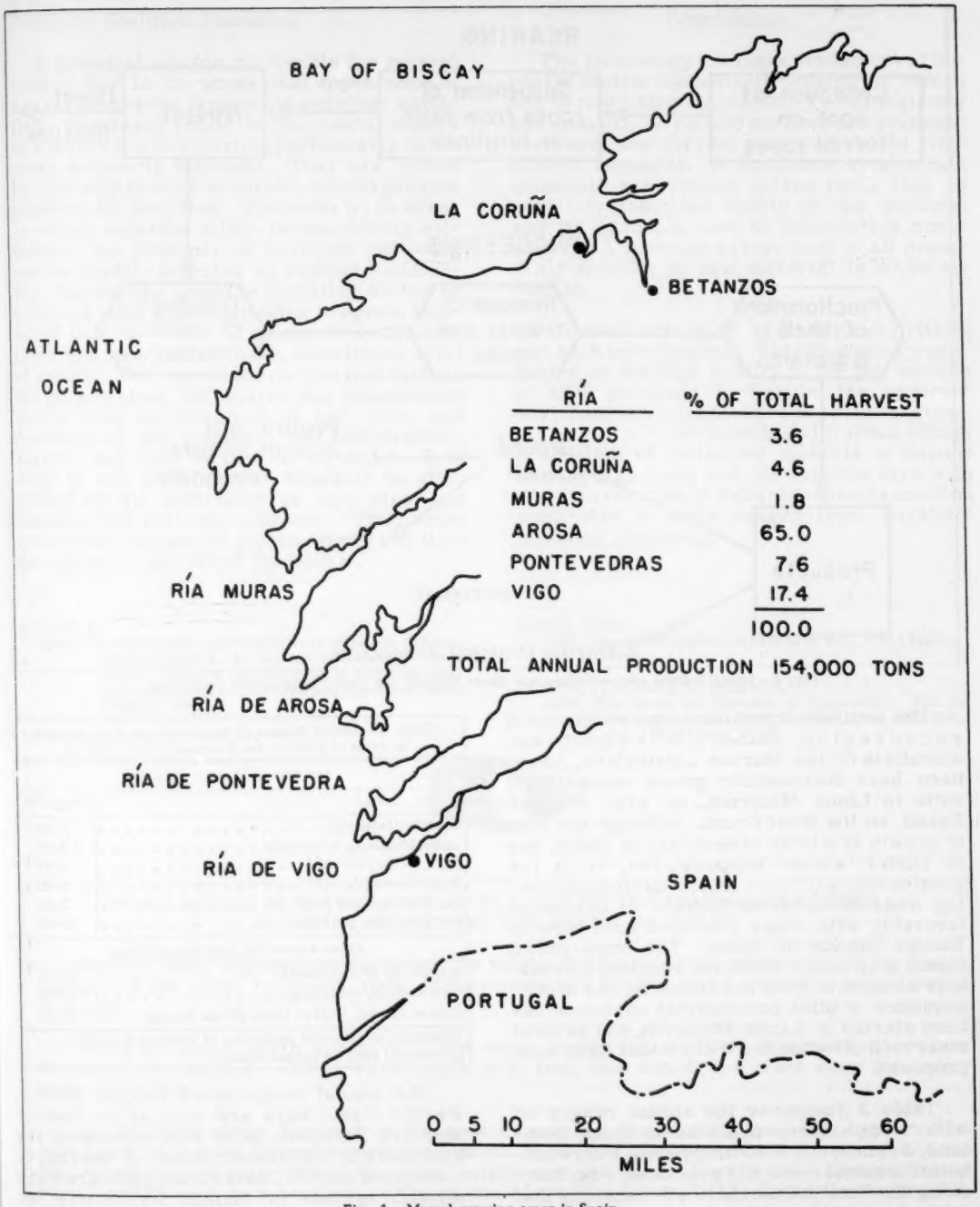


Fig. 1 - Mussel growing areas in Spain.

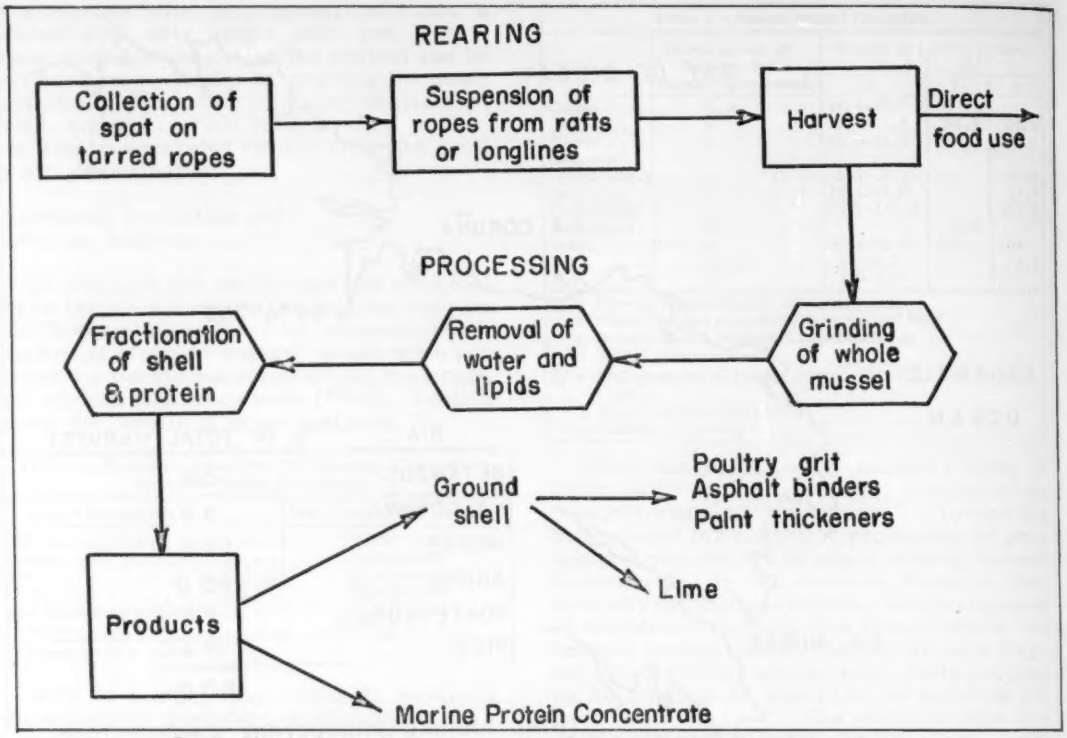


Fig. 2 - Mussel culture and processing into direct food use and protein concentrate production.

The Scottish experiments have been most encouraging. Mason (1969) reports that scientists of the Marine Laboratory, Aberdeen, have successfully grown mussels on rafts in Linne Mhuirich, an arm of Loch Sween, on the West Coast. Although the rate of growth is a little slower than in Spain, due to colder winter temperatures, it is far greater than any recorded for naturally growing mussels in Great Britain; it compares favorably with those recorded anywhere in Europe outside of Spain. The rope-grown mussels in Linne Mhuirich reached marketable size from seed in 14 months. As a consequence, a pilot commercial operation has been started in Linne Mhuirich, and several other loch sites on the West Coast have been proposed.

Table 3 compares the annual ranges of water temperature in areas in Spain, Scotland, France, and the Philippines, where off-bottom mussel culture is practiced, with those along the Pacific Coast of North America that might be considered for development.

Table 3 - Annual Ranges of Surface-Water Temperatures in Areas of Existing and Potential Mussel Culture

| Area | Temp. °C. |
|---|---|
| **Bay Mussel (Mytilus edulis)** | |
| Brittany (France)[1] | 5-20 |
| Linne Mhuirich, Scotland[1] | 2.5-20 |
| Bay of Vigo (Spain)[1] | 9-21 |
| Puget Sound (U.S.)[2] | 5-20 |
| San Francisco Bay (U.S.)[2] | 7-20 |
| San Diego Bay (U.S.)[2] | 14-20 |
| **Green Mussel (Mytilus smaragdinus)** | |
| Manila Bay (Philippines)[1] | 25-30 |
| Gulf of Calif. (Mexico)[2] | 21-30 |
| Gulf of Nicoya, Gulf of Dulce (Costa Rica)[2] | 28-29 |

1/Existing commercial production of cultivated mussels.
2/Potential area for mussel culture.

The annual temperature ranges of U.S. Pacific Coast bays are similar to those of Western European bays where mussels are successfully cultivated; those of the Gulf of California and the Costa Rican gulfs are quite similar to that of Manila Bay, where the green mussel is being cultivated.

## Paralytic Shellfish Poisoning

A potential source of trouble for mussel culture lies in the occasional appearance of a paralytic poison in mussels and other shellfish. Outbreaks occur in the coastal waters of western North America, particularly in the more northerly latitudes. They are caused by sporadic blooms of certain dinoflagellates ingested by shellfish. Fortunately, in areas in which mussels might be intensively cultivated, the presence of paralytic poisoning can be readily detected by regular monitoring. Harvesting would be curtailed during an outbreak until the monitoring program indicated that the level of poison in the mussel flesh had diminished to an established level of safety. The rate at which mussels release the poison after the source has disappeared varies with factors such as age, size, and condition of the mussels--and temperature, clarity, and rate of flow of the water. It is easy to see that monitoring would be simplified by the uniformity of age, size, and condition of cultured mussels. This would reduce the ranges of poison levels and time necessary to get rid of the poison.

## Conclusions

The technology for mass production at low cost of protein concentrate suitable for human use is now being developed. Technologically and economically sound methods are available even now, and current research should yield further advances. A limitation to accurate economic assessment arises from lack of certainty about the supply of raw material and its probable cost to prospective processors. A thorough assessment of all promising sources of raw material is obviously needed.

Mussels should be given high priority in any such investigation. This is strongly suggested by the high quality of the test sample of MPC produced in Seattle; the apparent environmental similarities of potential growing areas in North America with areas of high production of cultivated mussels in Europe and the Far East; and the relative ease with which harvesting of cultured mussels could be controlled to avoid danger from paralytic shellfish poisoning.

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### WHAT MAKES A VERY SLIGHT SWELL (WAVE) BECOME MUCH HIGHER WHEN IT BREAKS ON THE SHORE AS SURF?

Until a wave approaches the shore, its height is usually about one-twentieth its length (distance from crest to crest); thus, if the crests are 20 feet apart, the wave height would be 1 foot.

When the water depth equals half the wave length, bottom friction begins to slow down the speed of advance. With a wave length of 20 feet, this would take place when the water depth is 10 feet.

As the wave slows, the back of the wave crowds the front, piling the water higher. The lower part of a wave, being nearest the bottom, is slowed more than the top; as a result, the top begins to curl over. When the wave height reaches three-fourths the water depth, the wave topples over as a breaker. ("Questions About The Ocean," U.S. Naval Oceanographic Office.)

# FISHERY OCEANOGRAPHY--II

## Salinity Front at Entrance to Washington's Strait of Juan de Fuca

Felix Favorite

Little is known about the reaction of fish to conditions in their natural environment because measuring, monitoring, and understanding these conditions require a cadre of oceanographers with training in several disciplines and much time. Fishery oceanographers have not made the impact upon fisheries that could, or indeed must, be made if we are to understand completely the causes of long- and short-term fluctuations in the components of the resources.

### Where to Fish?

Once a net or other device has been retrieved, or a fishing operation completed, several things are apparent: the catch is either large or small, the fish are either the same or different species, and either marketable or unmarketable. Except for sorting and storing the catch, the men are ready to fish again. The question is: Where? If fish traces appear on the echo sounder, the problem is solved; if not, a search is begun on a grid, or at random. Standard oceanographic techniques of the past would help little at this point to decide in which direction to maneuver. It requires hours to take and process data from a Nansen bottle cast and ascertain the distribution of water properties with depth. Observations at 2 or more stations would be needed to determine a current pattern or other environmental features. And, of course, the analytical procedures are fairly technical. One cannot blame the fisherman for preferring to continue with his random or intuitive search.

### Modern Technology Helps

However, modern technology is rapidly reducing the tedious and time-consuming analytical work by providing equipment that permits direct readings of water properties significant to fishing. One such piece is a surface temperature and salinity recording device. With this device, a probe is inserted in the engine intake or attached to the hull's outer part, and a continuous record of temperature and salinity at the surface is recorded in the wheelhouse or other desired location. Continuously recording thermographs have been in use aboard some vessels for years, but the salinograph has been available only within the past decade. Instruments with high accuracy are expensive and not in common use, even aboard oceanographic or fishery research vessels, but less expensive models are sufficient for some purposes. The necessity of measuring salinity--and also recording it continuously to detect significant environmental changes--was clearly shown during recent cruises of two BCF research vessels: 'Miller Freeman' off California and 'George B. Kelez' off Washington.

### Pacific Salmon

One group of valuable fishes off the U.S. west coast is the Pacific salmon (genus Oncorhynchus). By intricate and incompletely explained mechanisms, they are able to return to the fresh-water stream or lake where they were spawned after 1 to 3 or more years in the ocean. It long has been suggested, and it is a reasonable hypothesis, that the discharges of rivers along the coast serve as guideposts. Until our high-seas studies began, it was generally believed that the salmon never migrated far beyond the continental shelf, or from the influence of their natal streams.

As far south as San Francisco, local runoffs from river systems to which salmon migrate can be detected as seaward plumes of low salinity. These plumes carry with them specific chemical relations, odors, or other identifying characteristics detectable by salmon. Such a plume was seen off San Francisco Bay during the Freeman cruise; its configuration was grossly delineated from data obtained at closely spaced oceanographic stations, rather than from a continuously

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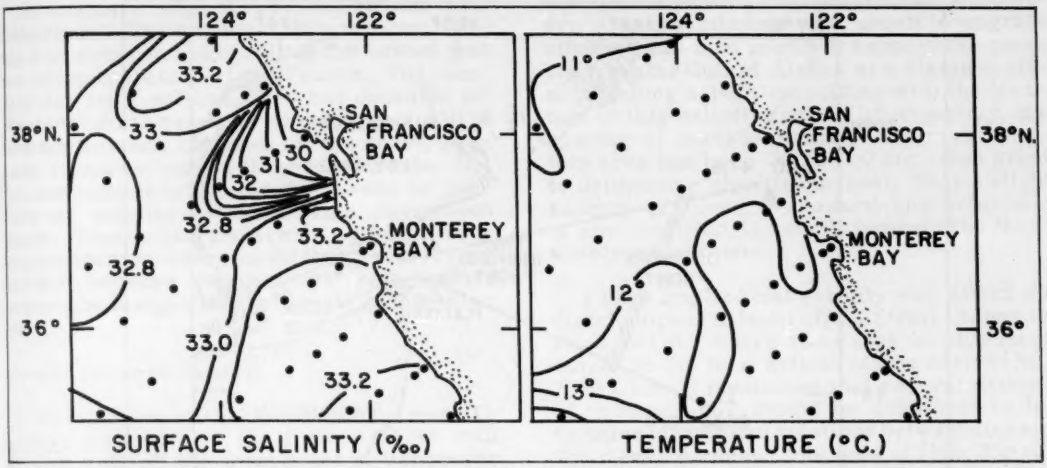


Fig. 1 - Distribution of surface temperature and salinity off San Francisco Bay showing plume of low salinity extending seaward, undetectable in the temperature distribution, February 1969. Station locations are shown by dots.

recording device (fig. 1). The seaward gradient of salinity is fairly well defined because the stations are only about 20 km. (12.4 m.) apart. But stations along the coast are 60 km. apart and, obviously, it is impossible to ascertain whether or not a sharp front exists at the northern and southern edges of the plume. It is also obvious that surface temperatures provide no indication of the plume's presence.

The Columbia's Plume

The area offshore of the Columbia River is a much better example. Not only can the plume be seen from the air--extending into the ocean during late spring, straight as a superhighway--but the demarkation line between the surface lens of silt-laden runoff and the relatively clear blue-green coastal water is obvious even aboard ship, when the north and south edges of the plume are crossed many miles at sea. In fact, the plume's seaward extent, as determined by dilute surface water, can be traced at times over 500 km. offshore.

However, just north of the Columbia River, the runoffs from rivers in Washington and southern British Columbia flow seaward through the Strait of Juan de Fuca. Tidal and turbulent mixing from sills in the inland waters reduces the possibility of this fresh water forming a dilute surface lens, and thereby maintaining its identify in the ocean.

Even up to the present, observations in the Strait at 10 to 30 km. intervals, made largely by local research vessels, have indicated only a slight salinity gradient from the Strait's inner reaches into the ocean, and no indications of a sharp salinity front at the entrance. Nevertheless, during an April 1969 Kelez cruise (she is equipped with continuously recording temperature and salinity device), we discovered 2 salinity fronts: a marked one inshore, with an increase of 2 to 4 ‰ (parts per thousand) in 4 km., and a lesser one offshore with an increase of about 1 ‰ over the same distance (fig. 2). These fronts also were noted in about the same position on April 4, a day later, as the vessel returned to Seattle along the same track.

The device was operated again as the vessel departed Seattle on April 16. The inshore front was clearly present about 75 km. northwest of one observed April 3-4, but the offshore front was not so clearly defined. Both times, the temperature changes across the fronts were slight, almost negligible. However, the salinity changes were large, considering that there is little change in surface salinity from the offshore front across the Pacific Ocean at this latitude. Thus, it is at this location that an organism might first detect any indication of coastal water. We know also from drift-bottle experiments that the flow along the coast is northward at this time of year. A northward flow of dilute water discharged through the Strait would explain why the southern inshore front lies so close to Cape Flattery.

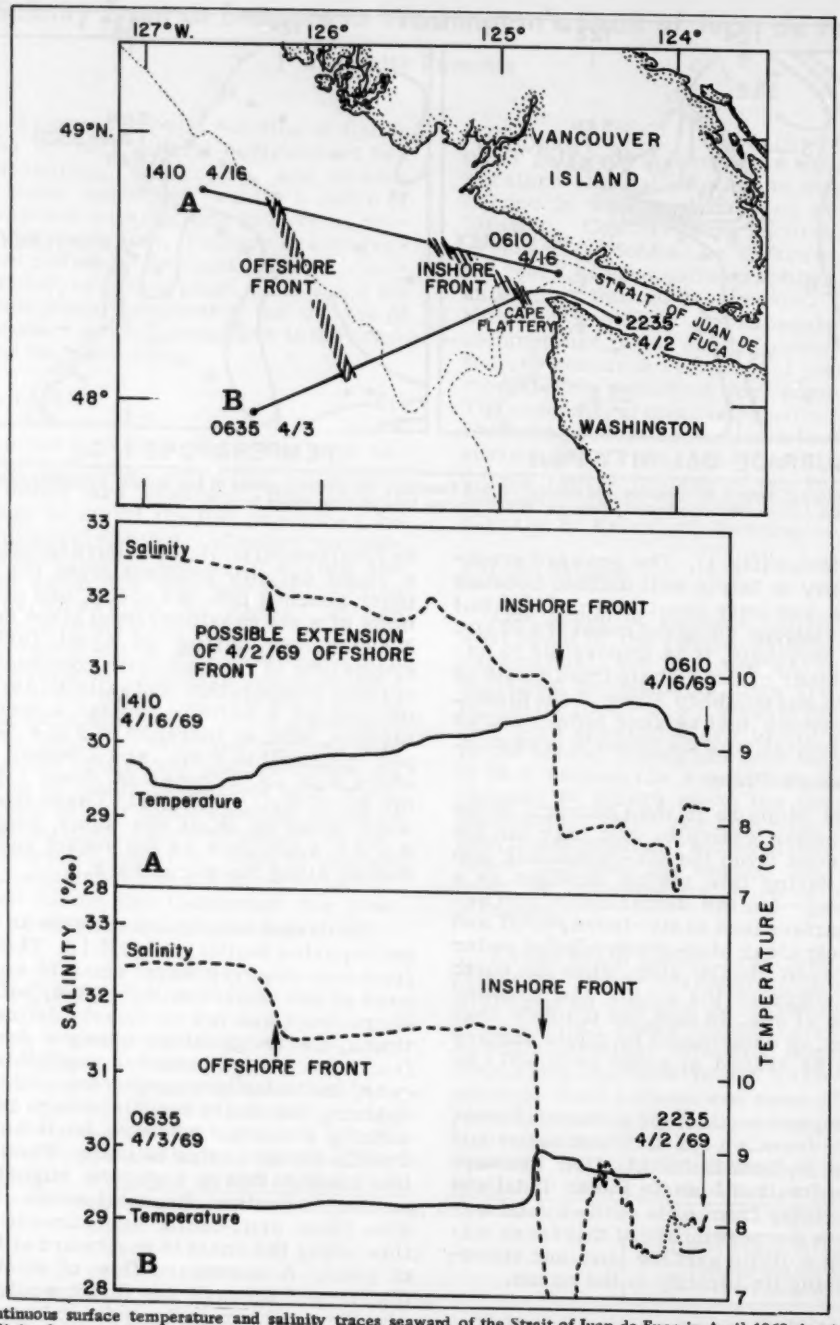


Fig. 2 - Continuous surface temperature and salinity traces seaward of the Strait of Juan de Fuca in April 1969 showing inshore and offshore salinity fronts at which temperature changes are slight. Temperature is indicated by solid line and salinity by dashed line. Dotted lines show traces originally recorded on a different time scale. Salinity trace for April 2 went off scale at 28 ‰ at about 3 a.m. on April 3.

Is this knowledge of use to the commercial fisherman? The answer is unknown--no fishing was done; on both cruises the vessel was merely enroute to and from Seattle. The commercial troll salmon fleet has operated off Washington for years; at times in spring it is in a north-south line well off the coast, perhaps at one or both of these local fronts. But it is impossible to be certain because no concurrent salinity measurements have been made. Even when fishermen make surface temperature measurements they are not very helpful because temperature just doesn't seem to be a significant property in this situation.

Fraser Sockeye Salmon

We also know that sockeye salmon (O. nerka) returning to the Fraser River mill around well off the west coast of Vancouver Island before they enter inshore waters--sometimes in such concentrations that they are easily observed from a plane. Furthermore, downstream migrants from southeastern Alaskan streams are known to migrate offshore and then northward around the periphery of the Gulf of Alaska at a distance offshore along a path coinciding with the location of this salinity front. Unfortunately, the spacing of surface salinity observations in this area has been 30 to 100 km.--too great to delineate a significant front. Only a slight salinity gradient, a seaward characteristic of any coastline, is usually indicated by these widely spaced data.

I have implied that salinity may affect the distribution of salmon off the Strait of Juan de Fuca, but the entire story may involve much more. In the first article of this series (July 1969 CFR), I mentioned that several aspects of oceanography should be examined to determine meaningful relations between fish and their environment. The food of fish, for example, would be a logical thing to study. With this in mind, we discovered in spring 1963 that euphausiids, a shrimplike planktonic

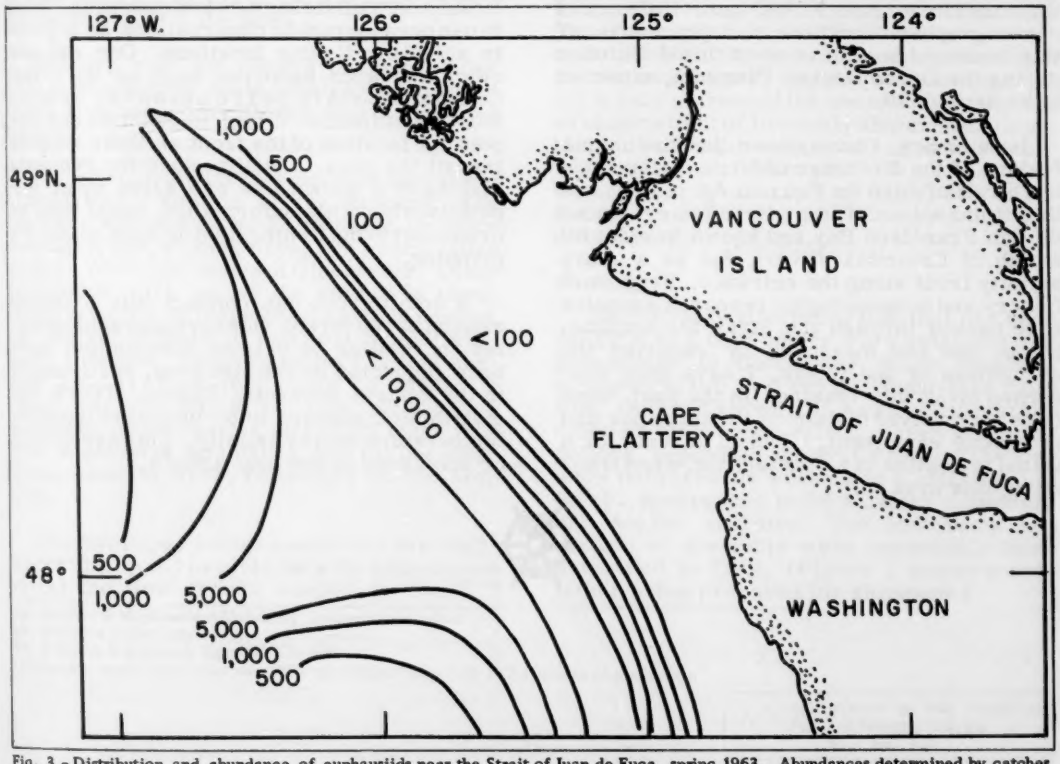


Fig. 3 - Distribution and abundance of euphausiids near the Strait of Juan de Fuca, spring 1963. Abundances determined by catches of euphausiids during 30-minute oblique tows from 30 m. to the surface when a 3-foot Isaacs-Kidd midwater trawl was used.

animal on which salmon feed, were concentrated near the 183-m. (100-ftm.) curve off the Strait (fig. 3). We do not know if euphausiids cannot tolerate the dilute inshore water, if they have enough mobility to avoid areas of low salinity, if they are quickly consumed by larger animals such as fish or whales, or if their distribution in spring 1963 was unusual. Is it possible that salmon feed heavily here before they enter inshore waters and migrate up their natal streams to spawn?

## Unanswered Questions

Other questions must be answered: What happens to these fronts when the northward coastal flow ceases in spring and the southward flow, characteristic of summer conditions, begins? What happens to them during the period of maximum runoff later in spring when the snow in the rainshed melts? What is the cause of the offshore front? What effect do the fronts have on the distribution of albacore (Thunnus alalunga) and other fish off the coast in summer? We know little about oceanographic conditions and processes off this coast and hope to correct this deficiency during the Ocean Decade Program, expected to begin in 1970.

In summary, I have shown that the unique feature of the discharge of dilute water out of the Strait of Juan de Fuca in April 1969 was that it did not exist as a plume (as evidenced off San Francisco Bay and known to exist off mouth of Columbia River), but as a sharp salinity front along the entrance. Vessels of fishery and oceanographic research agencies have passed through the Strait for decades, but no one had measured or reported the abruptness of the fronts. I have been concerned about this feature. In the past, when I was not involved in salmon research nor had recording equipment, I looked in vain for a visual indication of a coastal front when transiting this area.

Therefore, when one asks, "What conditions in the ocean may affect the movements of seaward and shoreward migrating salmon?"--and uses a proper instrument to measure critical water properties--interesting results are obtained and further hypotheses can be tested. This I suggest is fishery oceanography. Proper investigation of this front would require 2 vessels: a research vessel moving along the front and making oceanographic observations at the surface and at depth while searching with sonic devices for fish; and a vessel ready to fish on short notice when interesting conditions are encountered. It is important to observe environmental conditions--and to fish when stocks are known to be in the area. To do one without the other ignores half the task. Furthermore, this phenomenon is not necessarily a physical or chemical oceanographic feature. The biological oceanographic implications also are interesting.

One should make this phenomenon known to salmon troll fishermen and encourage them to use oceanographic observations as a guide in selecting fishing locations. One can ask other research agencies, such as the Coast Guard and ESSA (Environmental Science Services Administration), to observe and report the location of the front as their vessels transit the area. Usually, specific requests that have a known use are acted upon expeditiously. This information could then be broadcast to the fishing fleet in time to aid its planning.

A small group can conduct only a limited amount of research. Our oceanographic studies in relation to salmon distribution have been conducted on the high seas, particularly in the central Subarctic Region. There, the distribution appears to be indicated more by temperature than by salinity. This aspect will be discussed in the next article.

# FRESH FISH SHIPMENTS IN THE BCF INSULATED, LEAKPROOF CONTAINER

Robert L. Wagner, Allan F. Bezanson, & John A. Peters

The Bureau of Commercial Fisheries' leakproof, insulated, shipping container can be used to expand the markets for fresh fish to inland cities not now reached--provided reliable transportation can be found. This article describes tests made using the conventional nonrefrigerated trucking system to transport containers of fish to retail stores in three cities for 10 weeks. In general, the results were encouraging despite delays caused by trucking strikes in one city.

The March 1968 issue of COMMERCIAL FISHERIES REVIEW (CFR) contained a report describing the development of an insulated, leakproof, container at the Bureau of Commercial Fisheries Technological Laboratory in Gloucester, Massachusetts. It explained the need for a container suitable for extended shipment of chilled fishery products via air, rail, refrigerated or nonrefrigerated truck. It presented the details of the container, which we believe meets the need.

Now we give the results of an extended series of shipping tests in which we shipped fresh fish via conventional nonrefrigerated trucks.

Nonrefrigerated trucks provide service to almost every section of the country. The truckers will handle small lots (one or more packages) and, within 3 days, can reach cities within a 700-mile radius of Gloucester. These companies pick up at the shipper's plant, transfer to one or more truck lines as needed, and deliver directly to retailers or distributors. However, unknown factors in this service are: (1) time that might be needed to reach various cities, (2) type of handling container might receive and effect these factors might have on quality, and (3) the long-term, week-to-week, reliability of the service.

Therefore, we set up a series of test shipments that would provide us with information on (1) the time trucks needed to reach 3 selected cities, (2) condition of product and container on arrival, and (3) overall reliability of the service.

## Procedure

### Selection of Cities

One criterion used in selecting cities was distance. We wanted to have the shipments sent to 3 locations within a radius of about 700 miles from Gloucester. Another very important criterion was that there be a retail outlet in the city in which we knew, from previous contacts[1/] that people would be willing to help us record the necessary data each week for a total of 10 weekly shipments. Combining the 2 requirements resulted in selecting Burlington, Vermont, 175 miles from Gloucester; Syracuse, New York, 355 miles away; and Pittsburgh, Pennsylvania, 635 miles away.

### Packing

Each Friday afternoon, fish that had been caught 2 to 4 days before were obtained from processors in Gloucester. Each shipment consisted of two or three 25-pound-size fillet tins. One was filled with haddock fillets; the other or others with whiting, ocean perch, or pollock, depending on availability. The tins were held over the weekend in a chill room at 33° F., then packed in the shipping containers on Monday morning. The containers and method of assembly were essentially those described in CFR. (Figure 1 shows a container being prepared for shipment.)

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Mr. Bezanson is formerly Mechanical Engineer
Mr. Peters is Supervisory Research Chemist

1/Selection would have been very difficult without help from BCF Division of Marketing.



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Fig. 1 - Preparing BCF insulated, leakproof, container for shipment.

For the first 5 shipments, refrigeration was provided by ice frozen in polyethylene bottles, each containing about 2 pounds of ice. The bottles were placed under, beside, and on top of the fillet tins to provide 24 pounds of ice for the Burlington shipments and 30 pounds each for the Syracuse and Pittsburgh shipments. For the last 5 shipments, a slab of absorbent urea-formaldehyde foam was placed under the fillet tins, and 10 to 15 pounds of the bottled ice were replaced with an equal weight of loose flake ice. As the ice melted, the water was absorbed by the urea-formaldehyde foam, so no free water accumulated in the container.

## Shipping the Fish

Each Monday, for 10 weeks, the filled containers were picked up at the laboratory by a local intercity truck and taken to Boston, where the containers were transferred to interstate truck lines. On arrival, the containers usually were transferred again, either to a smaller truck of the interstate trucker, or to a truck of a separate company specializing in city deliveries. Then the containers were delivered to the final destination.

## Recording Information

On delivery of the containers, the recipient noted the date and time of arrival, condition of container, condition of product based on its odor and appearance, temperature of product, temperature of outside air, pounds of ice remaining, and whether any free liquid was present. The information was then mailed to the laboratory for summarizing. The findings are presented in table and discussed below.

## Results of Shipping Tests

### Burlington

On the whole, the shipments to Burlington were the most successful, particularly in punctuality; the slowest shipment was only $1\frac{1}{2}$ hours later than the fastest. Although the average of all product temperatures was 35° F., the products packed with bottled ice averaged 37° F., and those packed with some flake ice averaged 33° F.

### Syracuse

Deliveries in Syracuse were considerably more erratic than in Burlington. Of the 10 shipments, 5 arrived in about 1 day, but 3 others arrived in 3 days. The quality of the

Summary of Data Recorded During Intercity Shipping Tests

| Destination | Shipping[1] Time | | Condition of Container | Condition of Product | Product[2] Temperature | | Outside Air[3] Temperature | | Ice Used Per 24 Hours | | Amount of Free Liquid |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ave. | Range | | | Ave. | Range | Ave. | Range | Ave. | Range | |
| | . . (Hours) . . | | | | °F. | °F. | °F. | °F. | . . (Lbs.) . . | | |
| Burlington, Vt. | 25.5 | 25.0 to 26.5 | Good to Very Good | Good to Very Good | 35.0 | 32.0 to 39.0 | 52.0 | 30.0 to 67.0 | 5.2 | 3.0 to 6.8 | Trace |
| Syracuse, N.Y. | 45.5 | 23.0 to 77.0 | Good | Good to Excellent | 33.8 | 32.0 to 38.0 | 63.2 | 40.0 to 84.0 | 4.2 | 1.7 to 6.6 | None |
| Pittsburgh, Pa. | 70.25 | 50.0 to 75.0 4/ | Very Good | Fair to Good | 36.9 | 35.0 to 40.0 | 42.3 | 32.0 to 60.0 | 6.9 | 6.0 to 7.3 | Trace |

1/Shipping time is elapsed time between loading on truck at Laboratory and unloading at final destination.
2/Products were all at 33° F. when packed.
3/The outside air temperature in Gloucester at time of packing averaged 59.2° F. and ranged from 43.0 to 75.0° F.
4/Three shipments were delayed up to 1 week by various causes. These times are not included.

product, however, was unimpaired; temperatures were satisfactorily low, and sufficient ice remained to safeguard product for an even longer period. Again, products packed with all bottled ice had slightly higher average temperatures--34.5° F.--than those packed with some flake ice, where the temperature of the products averaged 33.0° F. The average of all shipments was 33.8° F.

Pittsburgh

Shipments to Pittsburgh were least successful. Two were delayed by strikes until the fish were inedible; in a third, the container was lost in the city and not found until after fish had spoiled. With the successful shipments, however, deliveries were punctual; although the temperatures of the fish were a little higher than desirable, they were not excessive, and no significant loss in quality had occurred. Differences in temperature also were noted in the Pittsburgh shipments. The products packed with all bottled ice averaged 38° F. compared with 35° F. for products packed with some flake ice. The overall average temperature was 36.9° F.

General

In all shipments (except those delayed by strikes or lost), the insulation lining the container ensured sufficient ice to keep fish properly chilled for at least another 24 hours beyond time fillets were received. The containers showed no evidence of rough handling: all arrived in good or very good condition, and the fillets showed no significant loss in quality.

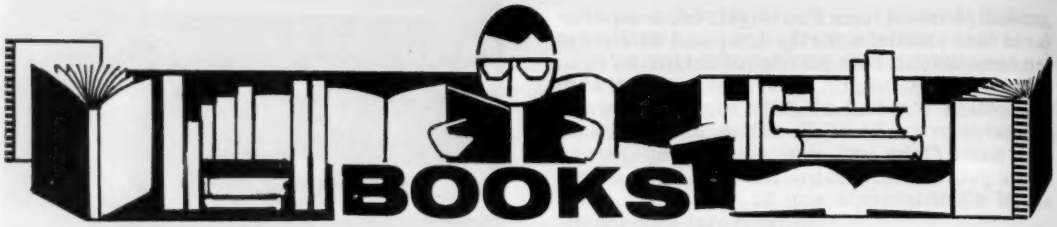


Fig. 3 - BCF Technologist prepares to examine shipment after delivery to retail store in Burlington, Vt.

Although delays were encountered in about 10 percent of the shipments, all occurred in one city where conditions were unusual at the time of our tests. In routine shipments, with improved communications between consignor and consignee, delays caused by strikes or other unusual circumstances might be avoided by selecting alternate routes or means of transportation.

## Conclusions

The conventional nonrefrigerated trucking system can be used satisfactorily to ship chilled fish to cities within a 700-mile radius of the processor. The BCF insulated, leakproof, container is eminently suitable for this use. It protects against loss of quality by preventing excessive increases in temperature during transportation; it prevents damage to other goods in the truck by ensuring that no fish juice or ice water can escape the container.




## DICTIONARY

"Multilingual Dictionary of Fish and Fish Products," compiled by J. J. Waterman, Fishing News (Books), 110 Fleet St., London, E.C. 4, England, 1968, 431 pp., $18.50.

Each of the 1,117 entries in this dictionary provides names, descriptions, and processing methods, if applicable, in French and English. The Latin name is given for each species. Common names also are given in German, Danish, Spanish, Greek, Italian, Icelandic, Japanese, Norwegian, Dutch, Portuguese, Swedish, Turkish, and Yugoslavian (Serbo-Croatian). There is a separate index for each language.

## FISH CULTURE

"The Fresh Water Cultured Fish Industry of Japan," by E. Evan Brown, Research Report 41, 1968, 57 pp. Information is available from Dr. E. E. Brown, Department of Agricultural Economics, Livestock-Poultry Building, University of Georgia, Athens, Georgia 30601.

Although Japanese farmers have raised fish for hundreds of years, production for commercial sale only began about 150 years ago. The industry grew slowly until the 1930's, but expanded rapidly during World War II. After the war, though largely ignored by the government, the growth continued. In 1950, output was officially calculated at 6,000 tons. From 1950 to 1966, volume increased to 41,000 tons, or by 583%. This was only $\frac{1}{2}$ of 1% of Japan's total 1966 catch, but 2.6% of the value of total wholesale sales. Each pound of cultured freshwater fish was worth more than 5 times the average value of other fish.

Dr. Brown spent July and August of 1968 in Japan studying freshwater fish culture. He describes the 4 major methods of culture, the 4 major species, marketing and institutional factors, and predicts the Japanese market for freshwater cultured fish will expand.

## FISH PROTEIN CONCENTRATE (FPC)

"Protein-Enriched Cereal Foods for World Needs," edited by Dr. Max Milner, 1968, 343 pp., illus., $6.50. Order from American Association of Cereal Chemists, 1821 University Ave., St. Paul, Minnesota 55104.

This book contains 32 papers by 38 authors. Many are devoted to recent experiences in commercial production of low-cost, protein-rich, foods. The increasing importance of sophisticated marketing techniques is emphasized. Attention also is given to new processing techniques and the use of unconventional protein concentrates in formulating cereal foods, including bread.

"Enrichment of Cereal Foods in Chile with Fish Protein Concentrate," by Julio Santa Maria is of particular interest. Sr. Santa Maria describes the effort made in Chile since 1950 to introduce fish protein concentrate (FPC) into the diet of low-income groups. He regards FPC as a biologically and socio-economically efficient protein-enrichment resource, stable, nontoxic, and entirely acceptable to those in need of additional high-quality protein--infants, children, and pregnant women.

He believes that adequate supplies of a satisfactory product are being delayed unnecessarily by insistence on esoteric 'quality standards,' which may be unnecessary in Chile. The 'best,' he believes, in this case, is the enemy of the 'good enough.' He concludes that "the critical state of child malnutrition, due largely to protein deficiency, calls for major early action. For Chile, it is clear that fish flour, used as a supplement to cereal foods, is a resource of first choice."

## NORTHERN FISHERIES

"Review of Fisheries in OECD Member Countries, 1968," Organization for Economic Co-operation and Development, Paris, 1969, 163 pp., $2.80. For sale by OECD Publications Center, Suite 1305, 1750 Pennsylvania Ave., Washington, D. C. 20006.

The Review covers the main fisheries developments in 18 countries--including Canada, Denmark, Iceland, Japan, Norway, and the U.S. The 18 countries provide about half the world's fish supply and handle around three-quarters the global trade in fish and fish products.

OCEAN ENGINEERING

"Handbook of Ocean and Underwater Engineering," edited by John J. Myers, Carl H. Holm and R. F. McAllister, McGraw-Hill Book Co., New York, 1969, 1,100 pp., illus., $32.50.

Designed to cover all aspects of ocean and underwater engineering, this work is the result of a cooperative effort between North American Rockwell Corp. and the U.S. Navy. Fifty-one recognized authorities in various fields of ocean and underwater engineering have contributed to it.

The practical engineering aspects are stressed in 12 major subject sections: basic oceanography; basic hydrodynamics; underwater fields and instrumentation; tools, rigging and machinery; underwater cables; underwater power sources; materials and testing; fixed structures; vessels and floating platforms; diving; ocean operations; and wind and wave loads.

PREDATOR CONTROL

"Electrical Installation for Control of Northern Sqawfish," by Galen H. Maxfield, Gerald E. Monan and Holbrook L. Garrett, SSR-Fisheries No. 583, Department of the Interior, Fish & Wildlife Service, 1969, 14 pp., illus. Available from Division of Publications, BCF, 1801 N. Moore St., Arlington, Va. 22209.

The northern sqawfish, a predator on young salmon and trout in major river systems of the Pacific Northwest, also is a serious competitor of desirable food and game fishes in many of the lakes and tributary streams of those systems. In northern Idaho, sqawfish, peamouth, longnose dace, and suckers have become the dominant fishes in water that formerly produced trout. The principal cause of this increase in rough-fish populations has been changes in the stream environment--warmer water, reduced bank cover, siltation, and intermittent flow.

An electrode array was used to divert sqawfish into traps during their spawning migrations at Cascade Reservoir, Idaho. This paper describes and illustrates the array, the methods used, and the results.

DATA PROCESSING

"Processing of Digital Data Logger STD Tapes at the Scripps Institution of Oceanography and the Bureau of Commercial Fisheries, La Jolla, California," by James H. Jones, SSR-Fisheries No. 588, Department of the Interior, Fish & Wildlife Service, 1969, 25 pp. Available from Division of Publications, BCF, 1801 N. Moore St., Arlington, Va. 22209.

The development of continuous sampling STD (salinity-temperature-depth) sensors as a prime data collection tool for oceanographic cruises requires development of techniques capable of handling the data with modern digital computing equipment. This paper describes a technique developed for processing STD data collected as part of the EASTROPAC Survey Program. Assuming that the data has been digitized and recorded on IBM compatible tape in the field, Jones describes the computer programs needed for processing the basic data tapes. A listing of the program with subroutines is given in an appendix.

SHRIMP

"Gulf of Mexico Shrimp Atlas," by Kenneth W. Osborn, Bruce W. Maghan and Shelby B. Drummond, Circular 312, Department of the Interior, Fish & Wildlife Service, 1969, 20 pp., illus., $2.25. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

Gulf of Mexico shrimp form the most valuable single U.S. fishery. From 1959 to 1963, an average of 107 million pounds (tail weight), worth $55 million to the fishermen, were landed annually. Three kinds of shrimp--brown, white, and pink--made up 98% of the landings.

The atlas illustrates the distribution and relative catches of the 3 species in the offshore commercial fishery. It also summarizes the commercial fleet's catch and effort, and the results of 15 years of exploratory fishing by BCF and the Fish and Wildlife Service.

--Barbara Lundy

# INTERNATIONAL

## International Herring-Tagging Experiment Begins

A large-scale herring-tagging joint experiment was scheduled to begin in July 1969 in the North Sea. Conducted by European countries, it is designed to estimate proportion of juvenile herring taken by commercial fisheries on Bløden ground and in northeastern North Sea and Skagerrak. In recent years, an increasing proportion of the catch there has been small herring.

The estimate is needed to assess effect of industrial fishing on recruitment to North Sea's adult herring stocks. The experiment also should provide useful information on movements of juvenile herring and pattern of migration.

Number Tagged Important

Success depends, among other things, on possibility of tagging sufficient number. To achieve this, tagging will continue from mid-July 1969 till mid-March 1970. It is hoped 50,000 to 100,000 fish will be tagged.

All tagging will be carried out by a 3-man team from Norwegian purse-seiner 'Gerda Marie' chartered for this purpose. All fish will be tagged with internal metal tags inserted into belly. Recoveries will take place in fish-reduction plants handling commercial catches. Throughout tagging, research vessels will assist Gerda Marie to locate good concentrations and by experiments aimed at assessing tagging-produced mortalities.

Analysis in Spring 1971

The researchers hope that there will be enough tags returned by spring 1971 to permit analysis. The results will be made known. (ICES, June.)

## Development of Fishing Systems for Distant-Water Fisheries Is Discussed

In April 1969, FAO's Department of Fisheries described the rapid improvement in the ways fish are found, caught, and handled as an "explosive growth in new technologies." At the 10-day International Marine and Shipping Conference in London in June, Dr. D. Bogucki, a Polish fishing-vessel design engineer, and Gordon Eddie, technical director of the British White Fish Authority (WFA), discussed the implications of this growth for distant-water fisheries. They said the increasing sophistication of the distant-water fishing vessel inevitably will make demands on engineer's skill and ingenuity.

Engineer's Role

Eddie strongly advocates engineer's role in research into vessel design and methods of fish catching and handling. Dr. Bogucki and his organization, the Ship Design and Research Centre (COKB) in Gdansk, are moving in same direction. ('Fishing News,' London, July 4.)

Evolution of a Vessel

Only 16 years ago (and in some distant-water fleets still operating) the typical ocean-going vessel was a very simple, single-decked trawler, usually less than 200 feet long overall. It bore unmistakable signs of sailing smack ancestry. It could be built by a small specialist yard for about US$240,000. It had evolved in ways "familiar throughout the history of shipbuilding." The skipper's main tools in finding and catching fish were experience, radiotelephone, and trawl itself.

While traditionalists may argue for the slow accumulation of experience, the economics of fishing demands faster methods.

Instead of $240,000 for a vessel of known performance and reliability, today's owner must risk a huge investment. He should know whether the vessel will do the job he expects.

Vessel of Future

Eddie and Bogucki mention the "far reaching concept" of a fleet whose nucleus would be

a depot ship, perhaps nuclear powered, able to stay on remote grounds for the 4-year period between surveys. Its special hull would enable it to serve as a port and repair base for catchers that would stay with it on the grounds. Preliminary studies by Polish naval architects show it is practicable and can be justified economically.

Marketing's Role

A correct choice of a fishing system cannot be made without an overall systems analysis from sea bed to consumer's plate. Marketing may help by influencing demand to ensure that the main capital equipment, the vessels, are fully utilized. Marketing "may have a noticeable influence on the choice of size, type, and layout of the deep-sea fishing vessel of the future."

## Antarctic Whaling Quotas Set for 1969/70 Season

Representatives of the Antarctic pelagic whaling countries--Japan, Norway, USSR--met in London June 20 to July 1. They agreed to submit a draft of an "Arrangement for the Regulation of Antarctic Pelagic Whaling" for the 1969/70 season to their governments.

The Quotas

The draft provides these allocations of the global quota of 2,700 blue-whale units fixed by the International Whaling Commission for the 1969/70 season: Japan 1,493 units; Norway 231; the USSR 976 units.

If the governments approved, the Arrangement would be signed on July 10 in Moscow. (International Whaling Commission, July 1.)

## European Communities Council Adopts Zero-Duty Fishery Quota

The European Communities (EC) Council has adopted a regulation for the opening and distribution of a zero-duty import quota of 46,000 tons for fresh, refrigerated, or frozen herring from third countries. The quota is valid from June 16, 1969, to February 14, 1970.

The Council explains that because some members import considerable quantities it would be inadvisable to levy a customs duty on them; also, the EC Communities have certain commitments within GATT. However, the herring imported within the quota must be in line with the Community reference price.

How Quota Divided

The 46,000-ton quota is divided into regular and reserve parts. The first part of 40,200 tons is: Germany 31,600 tons; Netherlands 5,600 tons; Belgium-Luxembourg 1,800 tons; France 1,000 tons; and Italy 200 tons. The 5,800-ton reserve may be distributed to members that exhaust their quota shares. (U.S. EC Mission, Brussels, July 7.)


## Japanese-Brazilian Firm to Start Fishing Shrimp Off Brazil

The Japanese firm Nihon Reizo has transferred about US$333,000 to its Brazilian subsidiary COPESBRA to build and operate three 100-ton shrimp vessels. Nihon Reizo owns 40% of COPESBRA's total shares.

COPESBRA (Companhia de Pesca Norte do Brazil) is whaling with one killer boat based at Recife. It is trawling for bottomfish with 3 vessels. So far, whaling has shown a profit of US$83,000, but bottomfish has lost the same amount. Therefore, Nihon Reizo decided to change from bottomfish to shrimp.

Shrimping at Amazon's Mouth

The 3 shrimp vessels to be built will be chartered under a joint venture for one year. Then they will become part of the joint venture under Brazilian laws. Shrimp fishing will be based at Belem and conducted at the mouth of the Amazon River. ('Suisancho Nippo,' May 12.)

## Japan Sends Fishery Team to Peru

Japan will send a 10-man fishery survey team to Peru in October in response to a request for Japanese cooperation in developing Peru's fishery resources. The survey will study the fish meal industry and develop proposals regarding future Japanese assistance.

The decision to send a mission to Peru was based on the fact that Peru claims a 200-mile territorial sea. Since Japan must cope with that problem, she needs to establish closer relations with Peru. ('Suisancho Nippo,' June 21.)

## Spanish-Moroccan Fishing Convention Published

A reciprocal fishing rights convention between Morocco and Spain was signed in January 1969. It divides the territorial waters of both countries into three zones and specifies the types of boats and equipment that may be used in each.

Three Zones

In zone A, from low-tide line to three miles offshore, only lines may be used, except for fishing anchovies, where appropriate purse seines and boats will be allowed.

In zone B, from 3 to 6 miles, trawling nets and purse seines may be used, provided that local fishing laws are observed and gross catch is limited to 50,000 metric tons. The exercise of mutual fishing rights in zones A and B will expire 10 years from the effective date of the convention.

In zone C, from 6 to 12 miles offshore, "historic rights" with respect to fishing are in effect. All types of equipment are permitted. Local regulations will apply equally to nationals of both countries.

Joint Ventures

An annex to the convention provides for Moroccan-Spanish cooperation in joint fishing companies (boats furnished by Spanish shipyards), and processing and marketing of fish products. (U.S. Embassy, Rabat, July 4.)

## Draft Treaty on Southeast Atlantic Fisheries

An international treaty to safeguard fishing grounds in the Southeast Atlantic Ocean off southern Africa will be discussed in Rome, Oct. 14-23. The conference is being convened by FAO, which has invited 18 governments most immediately concerned, FAO member and associate member nations, and interested international organizations.

After its scheduled adoption, the Convention for the Conservation of the Living Resources of the Southeast Atlantic will be open for signature by all UN members and specialized agencies. It will enter into force after formal ratification by a prescribed number of governments.

Creates Commission

The convention provides for creation of an international commission to study and recommend to member states the regulation of fisheries in the area. This lies off Africa's western coast, between the mouth of the Congo River and the continent's southern tip at 50° S. latitude. The commission will be assisted by scientific advisory committee.

Fishing in the area has more than doubled in the past decade, largely because long-distance fleets from other parts of the world have moved into it. Certain stocks, particularly hake and pilchard, have been exploited heavily.

## 50 Nations Discuss Fishery Investment Opportunities

More than 100 representatives of government, industry, financial institutions, and universities from 50 nations will meet at FAO headquarters in Rome, Sept. 18-24, to discuss ways of promoting fishery investments in developing countries.

The International Conference on Investment in Fisheries will encourage and facilitate investments by providing needed information on investment opportunities, and on sources and methods of financing.

Money & Information Needed

FAO said that difficulty in obtaining investment capital is hindering the efforts of many developing countries to promote fisheries as a source of protein food and of foreign exchange earnings. Information is lacking on sources and methods of obtaining such capital. In the developed countries, information is needed on opportunities for sound investment and fishery development. The conference will try to bridge the information gap and indicate where opportunities exist for investment and sources of money.

Speakers & Subjects

A special feature will be a panel discussion on prospects for fishery development in some developing countries. Participants from companies with overseas interests--and from international, regional, and bilateral assistance and financial agencies--will examine capital requirements. Methodology and international coordination of investment planning also will be covered. The aim will be to solve the problems of some segments of the industry that resulted from overinvestment.

Some 50 background papers have been prepared for consideration by the meeting. They include briefs on investment opportunities prepared by developing countries, lending policy statements by banks, discussions of project evaluation methods, analyses of bilateral support programs, specifications of criteria applied by private firms in making investment decisions, etc.

For information: Mr. R. Hamlisch, Secretary of the Conference, FAO Fisheries Department Rome, Italy.

## Fish Farming Combats Pollution

Fish farming, a growing source of protein foods, is receiving increasing attention as a means of water pollution control. This is reported in FAO's 'Fish Culture Bulletin' (Vol. 1, no. 3). The Bulletin highlights fish-culture developments around the world.

Polish scientists are experimenting with ways to convert nontoxic industrial waste, rich in organic compounds, into fertilizer for enriching fish-culture ponds. At the Academy of Sciences' Krakow Laboratory of Water Biology, sugar industry wastes have been used successfully to fertilize carp ponds. Such wastes increased fish production 5 times in test ponds in Golysz.

Polish Research

Almost similar results were obtained at the Research Institute of Fisheries and Hydrobiology in Vodnany. There, effluents from starch factories and waste water from poultries were used. Both substances, particularly the latter, produced life-sustaining plankton in ponds. There were encouraging increases in fish production and no residual effects.

Other Research

Researchers in India's Delhi University are using light to stimulate the breeding cycle of fish. The magazine states: "By exposing catfish to longer day lengths in the nonbreeding season by means of artificial light, it was found that the gonads attained maturity three months ahead of the normal season."

A "spectacular increase" in trout production is reported in France and Italy, which threatens Denmark's position as Europe's major trout exporter. Yugoslavia and Poland have begun to export trout to Germany. The Soviet Union also is becoming a major producer. Meanwhile, experiments are underway to grow rainbow trout in saline water. This would help reduce costs.

In Hamburg, Germany, common carp are being bred within the narrow confines of aquariums simply by maintaining a constant flow of water.

## Man-Made Lakes: Opportunities for Development

Man-made lakes for municipal and industrial purposes require farsighted planning to ensure maximum benefits. This is the theme of a new booklet, "Man-Made Lakes, Planning and Development," published by FAO and other international agencies. It is a guide to planners in developing countries especially.

The 71-page illustrated booklet notes that man-made lakes and reservoirs generally are planned to meet primary needs--hydroelectric power, irrigation, water for human and industrial consumption, flood control, or navigation. However, "their construction generates innumerable secondary problems, many of which have proved to be very serious." Most of these may not have been evaluated in advance.

### Ecologic Effects

These problems acquire primary urgency in time. They flow from the grave changes in a region's environment and ecology during and after construction of the lake. Populations must be displaced and resettled. Farm and pasture lands and forests are "drowned" by the rising waters. Fisheries may be destroyed by dams that hinder fish movements. Wildlife may be driven out. The entire economy and social organization are affected, even disrupted.

Poorly planned lake construction also may trigger explosive outbreaks of disease. In the Soviet Union, deforestation because of inundation led to increase in tick-borne encephalitis. In Asia, increased rice growing brought about epidemics of mosquito-borne encephalitis. The displaced peoples may carry their diseases as they migrate. Spreading waters also will transmit disease.

### Proper Planning Needed

Proper planning would ease or eliminate such problems, enhance the lake's value, and open up prospects for wider social and economic development. Science and education also could be enhanced, especially in developing countries, because trained technicians would be needed. Unequalled opportunities would be offered for commercial and sport fishery development and for local recreation and tourism. Conservation and esthetic beauty could be advanced, and forests and crops grown in ecological affinity with the lake. Transportation might be improved by a new water link. This would promote boatbuilding and inland port industries.

### Anticipate Problems

The booklet states: "Anticipation is the first key to the solution of the secondary problems that may arise when reservoirs are built." The second key is the "timely engagement" of the necessary experts to study all aspects of the project. "Dam engineering, with all its complexities, is a much more straightforward operation than the solution of all the ancillary social, economic, and ecological problems that arise before, during, and after the dam is built and the reservoir fills with water."

The publication carries a foreword by C.H. Clay, FAO Coordinator of Lake Projects. It was prepared with the aid of K. F. Lagler, School of Natural Resources, University of Michigan, U.S.A. It describes 4 African lake projects--Lakes Kainju, Kariba, Nasser, and Volta--in which FAO and other agencies assisted with planning and coordination of the type of studies described in the booklet.

## Japan & Indonesia Sign Fishery Agreement

On July 18, Japan and Indonesia signed a 3-year fishery technical cooperation agreement at Jakarta. Japan will assist Indonesia in research and education programs. Japan will provide gear and equipment costing about US$278,000 and send 4 specialists.

Indonesia will provide land, buildings, personnel, and pay administrative costs.

### Japanese Aid Sought

Fishery assistance is one form of technical cooperation sought by Indonesia from Japan. Japan hopes the agreement will smooth negotiations with Indonesia on pending fishery problems. These include extension of agreement for safe fishing of Japanese vessels, which expired July 26.

### Negotiations at Jakarta

The negotiations underway at Jakarta have produced temporary agreement to extend pact for one month pending further discussions. Since conclusion of the 1968 agreement, Japan has paid Indonesia about $30,000 in fishing fees for 96 vessels. ('Suisan Keizai Shimbun,' July 22, and 'Suisancho Nippo,' July 25.)

# FOREIGN

## CANADA

### RAISES CEILING ON FISHERIES IMPROVEMENT LOANS ACT

Canadian fishermen now will be able to borrow up to C$25,000 under amendment to Fisheries Improvement Loans Act raising ceiling from original $10,000. The Act has been amended further to let fishermen borrow up to 90% of a project cost instead of the former 75%. There is one exception: a loan for a vehicle can be only 66⅔% of purchase price.

A previous amendment freed interest rate on improvement loans. Now the maximum rate payable on the principal outstanding will be set twice annually. This will be 1% above cost of intermediate term money borrowed by the federal government.

What Act Provides

Some important points in the Act are: Loans may be made to buy or build a new boat; a used boat; repairs to boats; purchase of fishing equipment of all kinds and electronic fishing navigational aids; construction of buildings ashore and installations; and purchase of vehicles necessary for the fishing business.

More Lending Institutions

The Act also extended list of institutions that can make loans. Now included are charter banks, trust companies, loan companies, credit unions, and insurance companies. Loans must be secured. Details for a Fisheries Improvement Loan are worked out between fisherman and banker. The government is guarantor. ('Canadian Fisheries News,' July 15.)

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### MARITIME PROVINCES LANDINGS DROP IN MAY

In May 1969, 81.2 million pounds worth C$9.1 million exvessel were landed in the Maritime Provinces--Nova Scotia, New Brunswick, and Prince Edward Island. This included 37.5 million pounds of groundfish (C$1.9 million), 30.5 million pounds of pelagic and estuarial species (C$600,000), and 13.2 million pounds of shellfish (C$6.6 million).

Species Involved

Catch and value for each species group were lower than in May last year. The landings were substantially below the 1966-1968 average by about 7 million pounds, but the value was C$582,000 greater. Cod, herring, lobster, and scallop landings dropped slightly below the 1966-1968 average. Haddock, halibut, and flatfish decreased significantly (haddock dropped by 5 million pounds). Landings of ocean perch or redfish were almost 1 million pounds above the 3-year average.

Trawler Landings

Trawlers and draggers over 70 feet landed 28.4 million pounds during the month. This catch represented 75.7% of the groundfish landings and 88.5% of the scallop landings.

Total Landings

Total Maritime Provinces' landings for first 5 months of 1969 were 286 million pounds worth C$22.9 million. Total was 318 million pounds valued at C$24.1 million in 1968, and 200 million worth C$15.5 million in 1967.

Individual Provinces

The May catch, on an individual province basis, was substantially lower in all 3 provinces than in 1968. The catch in Nova Scotia was 41.2 million pounds (C$5.8 million), the New Brunswick catch was 34.2 million (C$1.4 million), and Prince Edward Island 5.8 million (C$1.9 million). This compares unfavorably with May 1968 when Nova Scotia landed 60.6 million pounds (C$7.3 million), New Brunswick landed 43.7 million (C$1.6 million), and Prince Edward Island, 8.5 million (C$2.9 million). (Economics Branch, Dept. of Fisheries and Forestry, Halifax, N.S.)

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Canada (Contd.):

## PAIR SEINE-NETTING TRIALS ARE SUCCESSFUL

An entirely new fishing technique, pair seine-netting, has been demonstrated successfully in a program to diversify small-boat operations on the Atlantic coast, Canada's Fisheries and Forestry Minister Jack Davis said recently. The method will benefit lobstermen in particular.

### High Catch Per Effort

Two Prince Edward Island (P.E.I.) lobster boats, towing a single net between them, caught 7,000 pounds of sole and cod in 3 hours. They fished in 20 fathoms off Souris, P.E.I. The boats were adapted for pair seine-netting under the direction of a Scottish fishing skipper, who also supervised the first fishing trial. He estimated that the new technique would allow 10 tows in a normal working day. The 7,000-pound catch was made in 3 short tows.

### Conversion Inexpensive

The machinery and gear needed to adapt the boats are relatively inexpensive, and the power requirement low, in comparison to regular draggers. Lobster fishermen should be able to work during the off-season months when normally their boats are tied up. Other types of low-powered inshore vessels also can be used, Davis said.

### Gear and Methods

The trial boats made the bumper catches with a small Scottish seine net. The Scottish captain intends to replace this with a high vertical opening Vinge trawl as soon as hake start to appear on the Souris grounds; he expects equally good results. The net used is funnel-shaped, similar to a regular otter trawl in principle. The lobster boat skippers hauled the net by using a small winch on each boat and coordinated operations by radiotelephone.

The new technique is similar to the pareja (pair) trawling done by Spanish deep-sea trawlers in the Atlantic. Further extensive trials and demonstrations will follow and the results made public. (Dept. of Fisheries and Forestry of Canada, Ottawa, June 23.)

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## WINNIPEG TO GET NEW FRESHWATER RESEARCH INSTITUTE

An ultramodern C$7.5 million institute is to be built on the University of Manitoba campus at Winnipeg. The building, a federally financed structure, will house all of the Fisheries Minister's freshwater development staff.

### Central Location

The University of Manitoba campus was chosen because 80% of Canada's freshwater lakes lie within a 1,500 mile radius of Winnipeg. The new Freshwater Fish Marketing Agency also is being located there because Winnipeg is the capital of Canada's freshwater fishing industry.

### Research Projects

The Institute, with an initial staff of more than 340, will be concerned primarily with the future of freshwater fishing and the quality of the water in lakes, rivers, and streams from coast to coast. The accent will be on development and directed towards fish farming and improvement of existing fish stocks in northern waters. The staff also will be responsible for studies on eutrophication in river systems as far apart as the Okanagan in British Columbia and the St. John River in New Brunswick.

### Renewable Resource Complex

The Institute buildings are the first of a series in what is expected to become "a renewable resource complex." It will include research laboratories, a working library, seminar facilities, fish-holding tanks, and pilot-plant facilities. It will be "second to none in North America," treble in size over the next decade, and attract some of the best biologists in the world.

### Other Activities

The new 188,000-square-foot building also will provide space for the Association of Universities and Colleges of Canada, the Department of Energy, Mines and Resources Inland Waters Branch, and the Department of National Health and Welfare's Public Engineering Division. (Fisheries Research Board of Canada, June 27.)

# EUROPE

## USSR

### MAY FISH ATLANTIC SAURY WITH ELECTRIC LIGHTS

In late autumn 1968, Soviet research vessels discovered large concentrations of Atlantic saury off Nova Scotia and on Georges Bank. Fishing with electric lights, exploratory vessels of the Atlantic Fisheries and Oceanography Research Institute (ATLANTNIRO) made good catches. The species reacts positively to electric light. It schools under blue light at about 20 meters; when blue flood lights are switched off and red lights are switched on, the school condenses and rises swiftly to the surface. This creates a "boiling" effect.

#### The Atlantic Saury

The Atlantic saury belongs to the same family as the Pacific saury (Scomberosocidae). It is distributed widely in the temperate and subtropical waters of the north and south Atlantic. It feeds on plankton and inhabits the surface layers of the open ocean. Its average length is 25-35 centimeters (maximum 45-46), and its average weight is 70-140 grams (maximum over 200). Migrations to the coastal waters of the U.S., Canada, Great Britain, and Spain have been observed.

#### Research Began in 1967

Soviet research on the stocks and biology of Atlantic saury began in 1967. Research and exploratory vessels of the Polar Fisheries and Oceanography Research Institute (PINRO) and ATLANTNIRO established that the life cycle of the Atlantic saury is associated closely with the Gulf Stream and the North Atlantic and Canaries Currents. Commercial concentrations were observed where the Gulf Stream converges with the cold Labrador current.

In Oct. 1967-Apr. 1968, ATLANTNIRO vessels discovered widespread saury concentrations in 2 areas (total of about 40,000 square miles) in the Gulf Stream off Newfoundland, and in the Newfoundland Basin.

#### When They Spawn

Apparently, saury spawn from Sept. to June. They reach their peak during winter-spring, when water temperatures range from 17 to 19° C. (62.6-66.2° F.). Spawning grounds in the North Atlantic are widespread, ranging from 46°30' to 28° N. lat.

#### May Be 2 Populations

Soviet scientists believe there are no less than 2 distinct saury populations in the North Atlantic--a west Atlantic (between 45 and 70° W. long.) and an east Atlantic one (between 13 and 38° W. long.).

In the South Atlantic, the convergence zones of the cold Falkland current with the warm Brazil Current, and the cold Benguela Current with the warm South-Equatorial Current, have the greatest potential for abundant, commercially exploitable concentrations of Atlantic saury. ('Rybnoe Khoziaistvo,' No. 5.)

#### Present Research

The Soviets are continuing exploratory research on Atlantic saury. At least one ATLANTNIRO research vessel is scouting the North Atlantic--from Georges Bank, along the Gulf Stream to the Newfoundland Basin--to determine the economic and operational conditions for a large-scale saury fishery using electric lights.

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### FAR EASTERN FLEET FACES REPAIR PROBLEMS

The Soviet Far-Eastern Fisheries Administration (DAL'RYBA) is facing serious repair problems for its fleet of 'Maiak'-class medium trawlers (SRTM). The reason is the shortage of floating docks capable of handling those vessels.

DAL'RYBA is well equipped to repair small SRT-300-class trawlers (260 gross tons). However, SRTMs (about 700 gross tons) have to be put in large floating docks designed to repair larger vessels such as stern factory trawlers (BMRTs) and factoryships. The smaller floating docks cannot hoist SRTMs. This has delayed considerably repair of BMRTs and large factoryships. The number of 'Maiak'-class medium trawlers of the Far Eastern fishing fleet has increased considerably over the last few years. Their

USSR (Contd.):

condition has deteriorated greatly because of maintenance deficiencies.

New Docking Technique

In 1967, 2 scientists at Kaliningrad Higher Navigational School devised a way to dock larger vessels in a floating dock designed for smaller vessels. The undisclosed technique is being introduced gradually only now because it had met with considerable skepticism.

After thorough and extensive testing, the method was approved by Soviet Fisheries Minister Ishkov and his DAL'RYBA Chief, Drozdov. Several SRTMs of that fleet have been repaired at Nevelsk shipyard on Sakhalin with the new technique. But Kamchatka and Primor'e shipyards continue to repair SRTMs in docks for large vessels. This is a bottleneck for entire Far-Eastern fishing fleet.

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FAR EASTERN SEALING FLEET IS AGING

The Far Eastern Fisheries Administration is concerned about the Sakhalin sealing fleet. Many of the catcher boats are close to 16 years old and in bad need of repairs.

Several boats were withdrawn from service in 1967. In November 1968, the Fisheries Ministry ordered 3 sealing vessels to be repaired at Nakhodka shipyards. By mid-May 1969, only 20% of the required repairs had been completed, and none of the 3 vessels was operational. ('Vodnyi Transport,' May 17.)

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RAISE FRESHWATER FISH IN SEA WATER

The All-Union Fisheries and Oceanography Research Institute is rearing carp and silver carp fry in Taganrog Bay of the Azov Sea. This is the first experiment in the Soviet Union in breeding fresh-water fish in the sea. The fry are held in pots at a depth of 3 meters. They feed on plankton and minced Azov sprat ("kilka"). The experiments are to last until late autumn 1969 and include zander, grass carp, and sunfish (centrarchid).

The purpose is to determine how freshwater fish acclimatize in marine conditions, how fast they grow, how much food they consume, etc. When tests have been completed, the Institute will issue recommendations for the culture of freshwater fish in marine waters.

Plans for Sunfish

The Soviets plan to release acclimatized sunfish in the Azov Sea hoping it will develop into a commercially exploitable species after a few years. ('Vodnyi Transport,' July 1.)

The source gives no indication of plans for the commercial introduction of the other species.

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UNDERWATER LABORATORY IS PLANNED

Soviet news media report that Moscow University's Marine Geology Laboratory plans to build an unmanned underwater "observatory" to hover above the ocean bottom and record the environment continuously. The first "observatory" is to be assembled in the Black Sea not far from the city of Evpatoriia.

The Lab

Access to the laboratory will be both manual (divers) and automatic (acoustic command). Data will be recorded and transmitted frequently (4-6 times a day). In addition, the marine seabed will be photographed, and the photos synchronized with surface oceanographic observations.

The "observatory" will not be on the seabed but above it. Divers apparently will be able to use the laboratory by floating it to the surface and descending with it. The idea has wide support in Soviet academic circles. Several professors, including Chairman Zenkevich of the Oceanographic Committee of the USSR Academy of Sciences, were interviewed about the project.

Lag in Making Instruments

While praising the project, the news media also pointed out that the making of oceanographic instruments is in a messy state. Instruments designed for similar functions are

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built in 3 or 4 laboratories separately, causing great loss of time and money. To avoid this, a Center for the Production of Oceanographic Instruments is advocated.

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## DEVISE NEW METHOD FOR SEALING FISH BARRELS

Specialists at the port of Klajpeda, Western Fisheries Administration, have suggested that fish barrels transshipped from medium trawlers to factoryships be topped with synthetic fabric held in place with a hoop. The conventional method is to seal barrels with a wooden top pressed into the barrel.

### Method's Advantages

The new method increases barrel capacity and prevents squashing the top layers of fish, thus conserving quality. It also simplifies refilling barrels with ocean water. ('Rybnoe Khoziaistvo,' No. 4.)

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## ROLES OF EFFICIENCY EXPERTS AND INVENTORS ARE EMPHASIZED

A conference of fishing-industry efficiency experts and inventors has reviewed proposals and issued recommendations for speeding up technical progress in the fishing industry. The conference, held in Leningrad at "Inrybprom-68," was attended by 250 experts and inventors from the 5 Fishery Administrations.

### Savings in 1967

"Technical creativity programs" (suggestions and inventions) involve some 25,000 fishery workers all over USSR. In 1967, adoption of the 26,000 technical suggestions and inventions saved 20.8 million rubles (US$22.8 million). The Western Fisheries Administration used 7,068 suggestions, saving 7 million rubles (US$7.7 million). The Far Eastern Fisheries Administration adopted 6,760, saving 6.6 million rubles (US$7.2 million).

### Areas of Future Effort

The conference directed the efficiency experts and inventors to concentrate on: (1) devising new and more effective fishing methods with electric light, electric fields, and pumps; (2) designing new equipment to mechanize and automate fish-catching processes; (3) designing new navigational, exploratory, and gear-control devices; (4) improving fish processing and packing machinery to reduce waste; (5) increasing variety of edible fishery products; (6) improving ship-repair technology and reducing demurrage due to repairs. ('Rybnoe Khoziaistvo,' No. 3.)

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## CONDUCTS MIDWATER TRAWLING EXPLORATIONS OFF NW AFRICA

Exploratory midwater trawling was conducted by the Atlantic Research Institute for Fisheries and Oceanography (ATLANTNIRO) off northwest Africa, January-March 1968. Results were excellent. The research vessel 'Gizhiga' and the commercial freezer trawler 'Petr Liziukov' tested a newly designed 38.5-meter (126.3-foot) pelagic trawl. Various Soviet-made fish-locating devices for midwater trawling also were tested successfully. Explorations were conducted at varying depths in 3 areas: at 60 to 120 meters off Dakar; at 25 to 40 meters off Cap Blanc (Mauritania); and at 30 to 50 meters off Rio de Oro (Spanish Sahara). The Soviets have only bottom-trawled on a commercial scale in the area. The successful tests may induce them to develop a midwater trawl fishery.

### Pelagic Trawling

Soviet interest in pelagic trawling mainly stems from the fact that the species they fish off northwest Africa (horse mackerel, mackerel, herring, Sparidae, and Scianenidae) school near the bottom only during certain periods of the year and at certain times of the day (mostly daylight). This has made the fishery strictly seasonal. However, these species are pelagic and frequently form huge midwater schools covering several hundreds of miles. 'Gizhiga' fished with bottom trawls in the daytime and with pelagic trawls at night. Best catches were at night. The operation proved the feasibility of a year-round commercial fishery using both pelagic and bottom trawls. ('Rybnoe Khoziaistvo,' Jan. 1969.)

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USSR (Contd.):

FILM INDUSTRY USES
DRIED KING CRAB SHELLS

A movie film factory in Kazan has requested the Far Eastern Fisheries Administration to supply it with dried king-crab shells. The factory will use them to produce color film. The Administration instructed 3 king crab factory vessels in the western Bering Sea of Kamchatka to fill the order. The shells will be shipped to Kazan from Vladivostok by Trans-Siberian Railroad.

## United Kingdom

FROZEN FISH PRODUCTION
BREAKS RECORD

Britain's domestic production of frozen fish rose by more than 13% in 1968 to 94,111 long tons (from 82,660 tons in 1967). Home sales of frozen fish, supplemented by imports, increased by over 5,000 tons to 114,000 tons. Overseas sales increased by more than a third to 16,000 tons.

The White Fish Authority has estimated that nearly 218,000 tons of white fish--23.4% of the landings--were used for freezing in 1968. In 1967, 189,000 tons had been used. ('Fishing News,' June 27.)

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WHITE FISH AUTHORITY NEEDS
LOAN FUNDS

An increase in loans for vessels and removal of restrictions on growth of the inshore fleet, announced by the government last year, have turned out to be paper promises that 'meant little in practice,' according to a White Fish Authority (WFA) report.

Loan Rates

Although the maximum loan rate was increased, loan funds available to WFA was limited to US$900,000. As a result, the higher maximum meant so little in practice that, in November last year, it was announced that no further loans could be approved until the government allocation for the following year was known. A much higher provision of $2,040,000 for 1969/70 will make it possible for 50% loans to be approved in some cases.

Trawlers

Removal of the trawler scrapping condition had very little effect on application for building new vessels over 80 feet. Only one application was approved in 1968/69. But the WFA, aware that one-fifth the trawler fleet is more than 15 years old, hopes that improved profitability, assisted by the new subsidy scheme, will encourage new building during the coming year.

Inshore Fleet

The inshore fleet provided most of the new orders. During 1968/69, there were 170 applications for inshore vessels; 120 were approved--70 for England and Wales and 50 for Scotland--and 45 were being considered at the end of March 1969. In the previous year, 95 applications had been approved.

In the last 5 years, WFA has approved 384 new inshore vessels--228 in England and Wales and 156 in Scotland. But the larger Scottish boats got assistance of $4,437,600, compared with $3,084,000 for English and Welsh boats. Improvement grants rose from 1,449 in 1967/68 to 1,543 in 1968/69; 1,044 were for inshore vessels.

Landing & Price Patterns

The year fell into two distinct phases. The first half was marked by heavy landings from Scotland and inshore ports in England and Wales, and by massive surpluses at Humber ports. This pattern of landings reversed in second half. With less pressure from cheaper supplies from elsewhere, and helped by their minimum price structure mechanism, the English ports benefited from their increased landings. WFA sees this pattern of price movements as "a classic demonstration of the need for a statutory minimum price scheme for the UK, with a system of reserve prices to support it."

Rising Costs

The report is ample evidence of WFA's own struggle against rising costs. Total income rose from $1,382,278 to $1,405,015 due to an increase of $38,400 from technical charges. However, costs jumped from $1,485,761 to $1,591,778, leaving WFA with a $186,763 deficit. ('Fishing News,' June 27.)

* * *

United Kingdom (Contd.):

## WHITE FISH AUTHORITY OFFERS NEW SERVICES

An almost unique management-and-design service now is being offered by the White Fish Authority (WFA) on a commercial basis to fish companies and vessel owners. The staff of the Industrial Development Unit (IDU) in Hull will give firms the opportunity to apply the results of IDU work to their own problems.

### The IDU

The IDU was established by WFA in 1963 to implement its research and development program. For the first time, highly qualified engineers were brought in to investigate and develop improved vessels, methods of fishing, and handling and distribution. WFA's technical director said: "This practical engineering approach has given us an unrivalled knowledge of fishing equipment and the way it is used."

In its 6 years, IDU has worked closely with owners, ship builders, and manufacturers. It has advanced considerably the techniques of measuring the performance of vessels and equipment under operational conditions; introduced the warp tension meter, Shetland gutter, hydraulic winches and power blocks, and improved echo-sounding systems; and developed new products.

IDU's success has aroused wide interest outside the U.K. Some leading fishing countries have been attempting to set up similar organizations. None has yet matched IDU's expert team of naval architects, mechanical, marine and electronic engineers, and operational research scientists.

### Needs More Money

According to the 1968/69 WFA report, the main restriction on IDU's work is the shortage of money. "It is difficult at our present level of expenditure," says the report, "to undertake projects requiring annual allocations of more than US$48,000." To cover projects ranging from development of a telemetry system for trawlers to a winch brake, the research and development program spent US$1,027,200.

One effect is that IDU is hampered increasingly by its own accomplishments. As these reach the application stage, IDU has to spend more time disseminating the program results. IDU's head says this is part of the job, although it strains his resources.

### WFA Report

The WFA report states: "It is not much use developing new techniques or equipment if the lessons do not get across to industry." It adds that the industry's appetite for information--which is provided in demonstrations, lectures, discussion groups--is "something we are not at present staffed to meet in full."

### IDU Services

IDU's services will not include research and development for individual companies that are separate from all-industry programs. IDU will provide expert service, backed by digital computer and other data-processing machines, where "it is obvious that substantial staff effort will be required to provide an adequate answer to a particular enquiry or request."

It will try to build the most into the design of individual vessels by operational research methods, production control systems for processing plants, sales analysis, lorry routing, stock control, intership comparisons of costs and earnings, and economic and statistical services.

On the design side, IDU will provide designs and sketch plans for new vessels, designs to instal new equipment, advise on how instruments should be used, conduct trials and analysis of results, and prepare schemes for factory and factory-deck layouts.

IDU is not competing with naval architects or yards; both will do the detailed work on the suggestions. It will continue to advise and aid industry without charge. IDU says: "The new service is in no way intended to discourage the ad hoc consultation and discussion, which is a continuous and essential feature of the Authority's relationship with the industry."

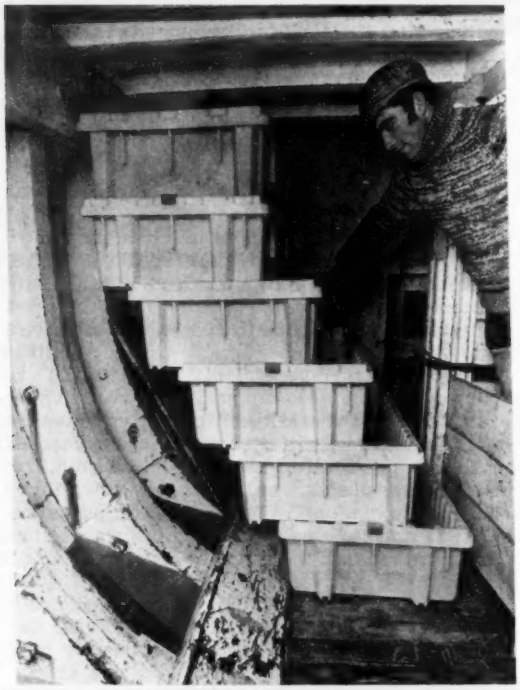
The service will permit IDU to apply knowledge gained from broad industry projects to the more specific needs of fishing companies. ('Fishing News,' London, July 4.)

* * *

United Kingdom (Contd.):

PLASTIC FISH BOX DEVELOPED

An all-plastic fish container has been developed by Pye of Cambridge. The company claims these advantages for it over the wood box: "Greater cleanliness, longer life, less weight, greater flexibility and ease of stacking, and greater ease of handling."



(Photos: Dunne)

The plastic box has been accepted by the Skagen Skipperforening, the Danish Fishing Skippers' Association. Deliveries have been made to Danish and Greenland fleets.

The plastic box measures 30" x 17½" x 8" and is designed to take 50 kilos of fish.

## Poland

MAKES GOOD CATCHES
IN NORTHWEST ATLANTIC

During first-quarter 1969, Polish fishermen made good catches in the Northwest Atlantic. Fishermen of the state-owned combine DALMOR caught over 50,000 metric tons of fish (species not known) during January 1-March 18, 1969.

DALMOR is the largest Polish deep-sea fishing company. Most Polish vessels sighted off the U.S. mid-Atlantic coast early in 1969 belonged to it.

To Fish Shrimp

Another distant-water fishing combine, ODRA, is planning to fish Georges Bank shrimp for canning. The 1969 quota was set at 200 metric tons. ('Polish Maritime News,' April.)

Earlier Catches

In 1968, the Poles caught 187,000 tons of fish from the entire ICNAF area (80,000 in subarea 5, Georges Bank). This was a sizable increase over the 120,000 tons (41,000 tons in subarea 5) caught in 1967.

Other Developments

In early 1969, the Poles began fishing southeast Atlantic hake off Angola. Daily catches averaged about 40 tons. In March 1969, 'Kwiska,' the first Polish trawler, was converted into a purse seiner.

* * *

Poland (Contd.):

## FIRST AUTOMATED STERN TRAWLER BUILT FOR FRENCH

On June 2, 1969, the flag was raised on the automated stern trawler 'Shetland,' built by Gdynia Shipyards for French owners, Nord Pêcheries of Boulogne sur Mer. It was designed by Gdynia Branch Office of Shipbuilding Industry's Design and Research Centre.

The Shetland is the 14th trawler built by Gdynia Shipyards for French owners, and the 25th trawler built by Polish shipyards for France. Shetland's prominent feature is extensive automation of the propelling system, engineroom arrangements, and fishing gear. The vessel will catch fish in the North Sea and North Atlantic grounds and ice them in 2 holds refrigerated to -4° C. (24.8° F.).

M/t Shetland. The prototype unit of the B411-type built at Gdynia Shipyard for French owners, Nord Pêcheries of Boulogne sur Mer.

### Vessel's Particulars

The main particulars are: length o.a.--60 m. (196.8 ft.); length b.p.--52 m. (170.6 ft.); breadth 11.60 m. (37.7 ft.); draught 4.25 m. (13.8 ft.); capacity 333 tons; speed at trials at draught of 4.25 m. and engine power of 1,500 hp. on the propeller--14.2 knots; crew 80; no. of berths 26; capacity of reefer holds 550 cubic meters, of fuel tanks 289 cubic meters, of fresh-water tanks 49.80 cubic meters, and of salt-water tanks 52 cubic meters.

### Electronic & Other Gear

Radio and electro-navigational aids are: radio transmitter and receiver, emergency transmitter, VHF radio station, radio-goniometer, gyro-compass and gyro-pilot, Decca radar, Decca navigator and course recorder, horizontal and vertical navigation and headline echo-sounders.

The main trawl winch is 3-drum, electrically driven, with a 12-ton hauling capacity. There also are 5 hydraulic winches: 2 can haul 6 tons and three 4 tons. This allows speedy and efficient heaving and shooting of nets and trawls. The fish are transferred through stern chute into storage compartment. Belt conveyors then move them to the processing compartment on bow. The fish are hand-gutted. After being rinsed in washing machines and separated, they are stored in loose ice in both refrigerated holds. ('Polish Maritime News,' June.)

* * *

## LED WORLD IN 1968 FISHING VESSEL CONSTRUCTION

Poland, Japan, and East Germany led the world in fishery vessel construction in 1968. Poland built 30 vessels (totaling 126,500 gross tons), Japan 347 (99,760 tons), and East Germany 68 (89,700 tons). Spain was in 4th place with 58 (54,400 tons). All were listed in "Lloyd's Shipping Register." (The Register does not list vessels of less than 100 gross tons.) ('Pêche Maritime,' Mar.)

### Exports

Many of the new vessels are exported. Polish-built vessels go to the USSR, U.K., France, Ireland, and other countries. East Germany exports to the USSR, Cuba, and Iceland. Japanese-built vessels go to the Republic of Korea and other countries.

### Soviet Construction

Soviets do not furnish statistics on fishery vessel construction, but just one of several shipyards builds about 24 large stern factory trawlers, 3,200 gross tons each, a year. The Soviets probably would be first, if they chose to publish data. Additions to the Soviet fishing fleet, including purchases from West and East European countries, exceed those of any other nation.

# THE SPANISH SEAWEED INDUSTRY

Norman W. Durrant

[The author, a BCF chemist, attended the Sixth International Seaweed Symposium, Santiago de Compostela, Spain, Sept. 9-13, 1968. He also investigated the Spanish seaweed industry.]

The seaweed industry, principally the manufacture of agar-agar, began in 1940 when the lack of Japanese supplies induced Spanish bacteriologists to try to obtain this product from Spanish seaweeds. Small-scale investigations were started and imitated Japanese techniques.

Spain has centered its seaweed activities primarily on the manufacture of agar-agar. This industry has undergone such a rapid development during the past 28 years that now the search for raw material has become the primary concern.

There are 3 techniques for collecting seaweeds:

1. From May to October, at low tide, people who live near the coast tear the seaweed off the rocks to which they are fixed. They are then spread on the beach and exposed to air and sun. The dried material is then sold to seaweed processors.

This system is used principally along the Galician coast and the coast of Spanish Sahara. This selective picking of seaweed offers a product of very high quality because only the species desired is collected.

2. Another harvesting technique involves frogmen. They operate from specially fitted ships from May to October. Although this technique is rather expensive, it results in the collection of higher quality seaweed.

This system has only been used during the past 10 years. During this period, extensive training and equipping of ships have been emphasized. Normally, ships 30 to 50 feet long are used, with 4 frogmen, a skipper, and one mechanic. By Spanish standards, the frogmen are extremely well paid. At the present time, over 100 ships of the above type are being used to collect seaweeds, almost exclusively the Gelidium species.

3. Finally, the most important procedure for gathering seaweeds is to pick them up on the beaches after they have been deposited by the autumn and winter storms.

The primary drawback to gathering storm-cast seaweeds is the necessity to sort out the undesirable species that collect on the beaches. Another drawback is the irregularity with which the storm-cast seaweeds are available. In one year, many tons may be washed ashore; in the next year, there may be nothing. This makes it difficult to maintain a labor force. In addition, storm-cast seaweeds are usually predominant in areas of high rainfall and humidity, and this makes drying difficult. To overcome this problem, the seaweed is usually transported to dry areas, such as the Castilian plateau in the interior. Of all seaweed collected in Spain, 70 to 80 percent is obtained through the storm-cast route.

## Types of Seaweed Gathered

The industrial raw materials of the Spanish coast are represented by Gelidium, raw material for the manufacture of agar-agar; Lichen carrageen for carrageenan, and Laminaria for alginates. Other seaweed species are also collected, though in small quantities: for instance, Fucus for the manufacture of animal fodder.

Almost all available seaweeds are located along the north and northwest coasts. There is an appreciable amount in the Spanish Sahara and a small amount around the Canary Islands.

## Processing Facilities

During 1940-1945, two small plants manufacturing agar-agar for their own use were constructed. These were Institute IBYS and Instituto Lorente. The latter was later converted to Productos Naturales Y Sintenticos, S.A., Prona.

During 1945-1950, two plants were erected and began production on a commercial scale: Explotacion De Algas, S.A., and La Techica Quimica Hispana, S.A.

From 1950 to 1955, two additional agar-agar companies were founded: Productos Quimicos Drovecol and Elaboracion De Productos Alimenticas Basicos, S.A.

From 1955 to 1960, another pair of commercial processing plants emerged on the scene: Productos Quimicos Navis, S.A., and Productos Y Derivados Marinos, S.A. During 1960 to 1965, the largest increase in production of agar-agar was obtained, 800 tons per year. Since 1965, six new companies have been formed for the commercial production of agar-agar. These are Sanval, Juste, Ceamsa, Movogel, Gummagar, and Roko.

In 1966, eight agar-agar processing firms formed a group under the name Hispanagar, S.A., which is now erecting a new plant in Burgos. Production capability is 1,250 tons a year. This plant initiated production at the end of 1968.

The primary problem the seaweed industry now faces is obtaining enough raw material to keep the plants in operation. The total capacity of all plants is now 1,800-2,000 tons annually; actual production was 890 tons in 1965, 600 tons in 1966, and 925 tons in 1967. This means that Spanish agar-agar plants have been operating at only about 42 percent of total capacity.

CARRAGEENAN--The processing of carrageenan from Carrageen lichen is insignificant. Almost all of the 300 to 600 tons of raw weed have been exported. In view of the increasing consumption of products derived from lichen in Spain, as well as in international markets, two companies are now constructing plants for commercial production of carrageenan. These plants are being constructed in Vigo and Burgos; proposed annual production is 400 and 180 tons, respectively. It is expected that these plants will absorb all the lichen seaweeds that can be gathered.

ALGINATES--The alginate industry is relatively new. The first efforts to produce this valuable material was tried in 1950, when an agar-agar manufacturer began a study of the possibility of extracting alginates from the Laminaria species, flexicaulis, claustroni, and sacorriza. He found the first two suitable for alginate production. In 1954, a small plant was installed, and he began producing sodium alginate. Even though the quantities produced were small, they were sufficient to supply the local market. One principal difficulty is obtaining sufficient raw material because Laminaria is collected by hand on rocky coasts. This contrasts with the massive mechanical harvesting techniques used by the U.S.

In 1959, the first independent alginate industry was developed. This industry, situated at Ribadeo, Province of Lugo, has an annual capacity of 120 tons of alginic acid. It produces primarily sodium, calcium, and ammonium alginates. The products are sold on the local market, but meet with difficulty on the international market due to the high cost of the raw material.

## Marketing Seaweed Products

Spain is the second largest producer of agar-agar in the world, exceeded only by Japan. However, the domestic use of agar-agar in Spain is not significant. Therefore, 85 to 90 percent of the agar-agar produced is exported to the U.S., England, Germany, Czechoslovakia, USSR, Italy, and Poland. Spain is the largest exporter of agar-agar in the world.

The collection of seaweeds is regulated by a decree of the Ministry of Commerce. It grants permits to manufacturers of seaweed derivatives for collection and acquisition of seaweeds in each area of the Spanish coast during a specified period.

## France

### BUYS JAPANESE LONGLINER FOR INDIAN OCEAN TUNA BASE

The French CIAP Corporation placed a 200-million-yen (US$556,000) order in July with the Japanese fish net and gear manufacturer Nippon Gyomo Sengu Co. for a 400-gross-ton double-deck longliner. The vessel is scheduled to be used in the Indian Ocean from the tuna base at Réunion Island. The island is a French possession about 400 miles east of Madagascar, and near Japanese tuna base at Port Louis, Mauritius Island.

CIAP Corp.

CIAP is a semigovernment corporation established in Saint Denis, Réunion Island, in late June 1969 with capital of about 100 million CFA franc (about $400,000). It was formed to develop a tuna base in the Indian Ocean in line with EEC common fishery policy of promoting the tuna fisheries.

Growth Plans

Initially, experimental fishing will be conducted with one longliner manned by natives and, eventually, fleet will be increased to 10 vessels. The catches will be delivered to tuna packers in France. At present, 30 Japanese longliners and about 80 Taiwanese and 20 South Korean tuna vessels are fishing in the Indian Ocean. ('Suisancho Nippo,' July 10 & 11.)

* * *

### FISHERY IMPORTS FROM COMMUNIST COUNTRIES DECREASE

French fishery imports from Communist countries decreased considerably during first 3 months 1969 from last 3 months 1968. Imports of canned crustaceans from the Soviet Union decreased to 556 metric tons in first-quarter 1969 from 1,125 tons in last quarter 1968. The 1969 value was 5.8 million francs against 15.5 million (about US$1 million against $3 million). Average value of one ton of Soviet crustacean imports decreased from 13,800 to 10,450 francs. Imports of "fresh and frozen crustaceans" from Cuba decreased from 540 tons in 1968 to 320 tons in 1969. The unit price was stable at 13,500 francs a ton in both quarters. (U.S. Embassy, Paris, June 4.)

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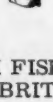
### TUNA LANDINGS FOR PACKERS DECLINED IN 1968

In 1968, yellowfin tuna landed in French ports, for delivery to packers, totaled 9,100 metric tons--compared with 11,500 tons in 1967. Imports were 2,100 tons (1,000 tons in 1967). This information is provided by the representatives of the Japan External Trade Organization stationed in Paris from the report on fish canning by the French Fisheries Section of the National Canning Industrial Professional Committee.

Landings & Imports

Domestic landings and imports of 11,200 tons (12,500 tons in 1967) represented 9,700 tons (10,900 tons) of canned product. Tuna shipments from Africa to French canneries totaled 27,500 tons (19,900 tons) in landed weight and 20,000 (14,200 tons) in equivalent canned tonnage. In addition, 11,000 tons of canned tuna were packed in Senegal during 1967-68, compared with 8,900 tons during 1966-67. ('Suisan Tsushin,' July 11.)



## Denmark

### FAROESE FRESH FISH DELIVERIES TO BRITAIN DECLINE

Faroese fishery exports to Great Britain have declined appreciably. During the first four months of 1969, total deliveries were 758 tons valued at US$168,000, less than half the value of a few years ago. During March 1969, one vessel's catch of about 22 metric tons of iced fish was delivered to Aberdeen, Scotland. It was valued at less than US$3,500.

Causes of Decline

Causes of the decline include: (1) reorganization of fishing operations for herring, and (2) fish are being filleted and frozen for sale to the U.S. The prices obtained in the U.S. are higher than those paid for fresh fish in Great Britain.

The Faroe Islands are beginning to create a profitable frozen fish market in Sweden. ('Dansk Fiskeritidende,' June 6.)

## Sweden

### SHRIMP IMPORT REGULATIONS AFFECTED BY KENNEDY ROUND

Fresh, chilled, frozen, dried, or salted shrimp, whether peeled or not, and unpeeled shrimp boiled in water are duty free. The duty on other shrimp is $5\frac{1}{2}$ U.S. cents a lb. This rate is affected by the Kennedy Round. According to customs authorities, it will change on Jan. 1, 1970, to: 1970--$4\frac{1}{2}$ cents; 1971--4 cents; and 1972--$3\frac{1}{2}$ cents.

#### Some Imports Licensed

Imports of unpeeled shrimp boiled in water were licensed Mar. 1, 1969. The licensing requirement does not now involve automatic quantitative restrictions; all license applications have been granted. Possible reasons for denials include unreasonable quantities or unrealistic pricing. The National Agriculture Board continues to study the question of shrimp imports. Controls on this trade are not contemplated soon. Imports of licensed shrimp, Mar. 1-July 1, 1969, were US$2.9 million, compared with normal annual imports of US$1.9 million.

#### Color Additives

No special sanitation requirements concern imports of U.S. or other shrimp; they are not subject to inspection procedure. Some color additives are approved for preserved shrimp and boiled peeled shrimp to be frozen. (In the latter, provided it is sold to ultimate purchaser in original container clearly showing color additives were used.) Only Poncean 4R (Color Index No. 16255) is presently permitted for other boiled shrimp. U.S. preserved shrimp will, in other respects, meet Swedish requirements.

#### Icelandic Fish Imported

The distribution of Icelandic fresh (not frozen) shrimp, air shipped to Stockholm, has just started. The high-quality shrimp will cost about same as U.S. shrimp. Due to poor herring catches, Icelandic fishermen have become more interested in shrimp fishing, which has not been tried to any great extent. The fishing is convenient to western Iceland.

#### Longer U.S. Season Possible

Swedes are surprised that U.S. shrimp fishing ends during warm season. It seems U.S. summer catches yield poor-quality shrimp with high water content. However, experience in Sweden and Canada indicates high-quality U.S. shrimp could be found during warm season in deeper and cooler water. (U.S. Consulate, Goteborg, July 7.)

## Norway

### EXPEDITION TO TAKE PART IN ANTARCTIC WHALING

Two small Norwegian whaling expeditions are planned for the coming (1969/70) season's Antarctic whale hunt. Experienced whale gunners in the Sandefjord area plan to equip a 2,500-GRT factoryship and one whale catcher. Another vessel, a 175-foot-stern trawler (900 GRT), is expected to be finished before the fall. It is financed partly by a US$250,000 loan from the District Development Fund. Its owner has been promised a concession for Antarctic whaling. This would indicate government interest in resuming whaling in those waters.

#### To Hunt Finbacks & Sei

The 2 expeditions plan to hunt finbacks (Balaenoptera physalus) and sei whale (Balaenoptera borealis). Both species are covered by international quota. There are plans to hunt also the smaller bay whale (Balaenoptera acutorostrata) and market its main product, whale meat, in the U.K., Japan, and possibly Norway.

#### Approves Whaling Commission Action

The Ministries of Foreign Affairs and Fisheries are satisfied with outcome of recent meeting of the International Whaling Commission (IWC) in London. The reduction in the Norwegian Antarctic whaling quota by 500 units to 231 blue-whale units reflects the current status of Norwegian whaling; nevertheless, it maintains basis for possible new (small-scale) development of Norwegian whaling in the Antarctic. An official asserted that unilateral reduction of Norwegian Antarctic blue-whale quota for 1969/70 season will not prejudice future Norwegian quotas. (U.S. Embassy, Oslo, July 15.)

* * *

Norway (Contd.):

## SALMON CATCHES DROP

Norway's catch of salmon and sea trout decreased 21% from 1967 to 1,618 metric tons in 1968, according to preliminary data of the Central Bureau of Statistics. As in previous years, nearly all of the 1968 catch was in Norwegian waters: 276 tons in rivers, 1,342 tons along coast.

The good catches of salmon in the last few years by foreign vessels in international coastal waters attracted about 100 Norwegian longliners this spring. This offshore fishery ended in late June. It yielded a Norwegian catch officially estimated at about 400 tons. About 40% of the fish were small (2-6 lbs.); the quality was generally fair.

### Inland Waters

No data are available for the current fishing season in inland waters. The season is limited by law to May 1-Aug. 4. Reportedly, salmon fishing has been extremely poor. The large salmon--the angler's trophy and bearer of highest market price--has failed to appear. The large salmon normally enters Norwegian rivers in its mating run before midsummer.

### Overfishing Charged

The reduced 1968 catches and the poor ones so far this year have provided ammunition to proponents of banning salmon fishing in international waters. One government fishery specialist believes that the complete failure of the 1969 salmon fishery in Norwegian rivers undoubtedly reflects overfishing in international waters. There is no reason to assume salmon fishing will improve, he said. From now on, only smaller salmon can be expected to enter the rivers.

### Union Disagrees

This conclusion may be premature. According to 'Fiskaren,' organ of the Fishermen's Union, June 23, exceptionally large schools of salmon, including large ones, had been observed in the fjords of Sunnmøre on west coast. If this is correct, and similar developments are pending, perhaps the salmon have only been delayed in their mating run up the rivers. (U.S. Embassy, Oslo, June 28.)

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## INTEREST IN GEORGES BANK HERRING FISHERY GROWS

Norway's largest factoryship, 'Gadus,' owned by a major Oslo shipping company, was scheduled to leave Norway in August for Georges Bank. The expedition is supported by the Fisheries Directorate in Bergen. It will explore those waters for possible exploitation. The Gadus has a production capacity of about 800 tons of frozen fillets.

Reportedly, frozen herring fillets are in short supply in European markets. Norwegian interest in exploiting the Georges Bank herring resources has been evident for months.

### Possible Fishery

A successful expedition to Georges Bank could lead to limited direct Norwegian participation. Large-scale operations, involving purse-seining for reduction purposes, appear unlikely. This is because of the distance to Europe and the questionable profitability of floating fish-reduction plants.

### Canadian Interest

Indirect participation in fishing for reduction purposes seems more likely. Canadian fishing interests are negotiating the charter of 30 to 40 Norwegian purse seiners. A substantial part of the Norwegian purse-seine fleet is now idle or engaged in other fishing operations due to reduced shoalfish stocks (compared with last year).

Also, 'Fiskaren,' July 3, reports that the largest Canadian fish-reduction company has ordered a complete factory from Stord Bartz Industri A/S. The plant will be erected in Newfoundland. It will have daily capacity of 1,000 metric tons of raw fish. This reduction plant will be the 14th delivered by Stord Bartz Industri A/S to Canada in the last 4-5 years. (U.S. Embassy, Oslo, July 22.)

## Hungary

FISH PONDS YIELD MORE FISH

Farmers in Hungary have found a new way of producing more fish, fowl and grain. They dig ponds. The practice began as an experiment about a decade ago. It is being carried out on a growing scale by farm and fishery cooperatives in various parts of the country, especially where the land is poor.

Stocked With Carp & Duck

The farmers build large ponds and stock them with several varieties of carp (a popular fish in Eastern Europe), eel, and Long Island duck. The ponds vary in area from several acres to several hundred acres. They average four feet in depth.

The carp help satisfy consumer demand in their land-locked country. Hungary now derives 80% of her 30,000 ton annual fish production from ponds. Much of the duck, and almost all the eel, are exported.

Planted With Grain

The carp and duck are carefully tended, harvested, and sent to market. Then the ponds are drained, and rice, maize, and other crops planted. Resulting harvests are up to 20% higher than for similar crops grown elsewhere in the country. The high sodium soil has been improved by the action of the water and fertilized by the carp and duck droppings.

Continuous Production

After each harvest, the ponds are reflooded and the process repeated, generally on a 3- to 5-year cycle. This establishes a continuous chain enabling the same plot of normally unproductive land to yield fish, fowl, and crops. The system is efficient and economical, and requires few attendants.

Ancient Principle

The principle is an ancient one. It was known to Chinese farmers who achieved "balanced" ponds, harvesting the grass and weeds to feed the pigs and cattle that fertilized the ponds. ('FAO News.')

## Switzerland

IMPORTS FISH MEAL

Despite her small size and relatively small population, Switzerland imports significant quantities of fish meal. Peru retained her position as chief supplier during the first quarter of 1969, followed by Chile, Norway and Denmark. Whether advantages to be gained by Denmark and Norway through their European Free Trade Association status will change this balance remains to be seen. (Agricultural Attaché, U.S. Embassy, Bern, June 20.)

| | Jan.-Mar. | | 12 mos. |
|---|---|---|---|
| | 1969 | 1968 | 1968 |
| | . . . (Metric Tons) . . . | | |
| Peru | 8,423 | 4,519 | 14,361 |
| Norway | 2,008 | 1,492 | 5,040 |
| Denmark | 1,888 | 2,720 | 12,264 |
| Chile | 1,785 | 3,387 | 11,892 |
| Ethopia | - | - | 30 |
| W. Germany | 120 | 3 | 23 |
| South Africa | - | - | 373 |
| Iceland | - | 370 | 857 |
| France | - | 60 | 340 |
| Total | 14,224 | 12,551 | 45,180 |


## West Germany

INTERNATIONAL SYMPOSIUM ON CULTIVATION OF MARINE ORGANISMS

"International Helgoland Symposium, 1969" on "cultivation of marine organisms and its importance for marine biology" will be held at Helgoland, West Germany, Sept. 8-12, 1969.

The symposium sponsors hope it will help to assess the present status of knowledge on cultivation of marine organisms, point out important problems to be solved and neglected areas of cultivation research, and provide solutions to difficult methodological problems. Papers will be presented on microorganisms and plants, animals, and ecosystems. Informal sessions on fish-farming and cultivation of plankton populations will be held.

For further information: contact the Director, Biologische Anstald Helgoland, 2 Hamburg 50, Palmaille 9, Federal Republic of Germany. ("International Marine Science," April.)

# LATIN AMERICA

## Cuba

### ELECTED TO UNDP GOVERNING COUNCIL

Cuba was elected to the UN Development Program (UNDP) Governing Council in early June 1969 by secret ballot of the 27-member UN Economic and Social Council (ECOSOC). Cuba is not a member.

UNDP Governing Council was formed in 1965 to coordinate and consolidate all UN technical aid and development programs. Its 37 members exercise direct policy control over the programs.

Only 3 (ECOSOC) members are from Communist countries: USSR, Bulgaria, and Yugoslavia. Since all 5 members from South America (Argentina, Guatemala, Jamaica, Mexico, and Uruguay) had opposed Cuban election, votes must have come from Asian and African delegates.

#### Edges Out Argentina

Cuba was elected by a vote of 14 to 13 over Argentina, the South American candidate preferred by other Latin American nations. Mexico, favored by the U.S. and Latin Americans, also was elected.

#### Fishing Industry Expands

In the world of fishing, Cuba's election may be more significant than in the political world. Cubans are rapidly expanding their fishing industry. In the past they received considerable aid from UN. They may apply for more.

**CORRECTION**

Dr. J. W. DeWitt, author of "Pacific Salmon Introduced into Southern Streams" (of Chile), CFR July 1969, p. 58, has asked that end of next-to-last paragraph be changed to read: ". . . to spawn in the Chilean fall of 1971."

# SOUTH PACIFIC

## American Samoa

### TUNA PRICE IS UNCHANGED

Tuna delivery prices at American Samoa for July 1969 were the same as June's, according to an agreement reached between Japanese suppliers and U.S. packers.

The July delivery prices per short ton were: round albacore: frozen US$425, iced $410; gilled and gutted yellowfin: frozen $342.50, iced $322.50.

The Japanese had asked for a $5-a-ton increase for albacore. ('Suisan Tsushin,' July 12.)

## Western Samoa

### SEEKS JAPANESE FISHERY AID

Western Samoa's Prime Minister Mata'afa visited Japan June 15-30 at the invitation of the Japanese Pacific Ocean Society. He indicated his wish to receive technical fishery assistance. Western Samoa, with around 145,000 people, wants to build her fishing industry on the Japanese pattern and is looking to Japan for capital investments.

#### Japanese Investments

Prime Minister Mata'afa also requested that Japan approve the investment planned in Western Samoa by Taisho Shamitsu Industries, Ltd. In February 1969, that firm was licensed by Samoa to establish a corporation.

The Japanese firm plans to invest 100 million yen (US$278,000) to build a 100-ton cold storage--and to operate two 20-30-ton fishing vessels for pole-and-line and gill-net fishing, primarily for lizardfish. Japan's Fisheries Agency plans to send a survey mission to Western Samoa. ('Shin Suisan Shimbun,' July 7.)

# ASIA

## Japan

### SALMON MOTHERSHIP FLEETS END FISHING

The 11 Japanese salmon mothership fleets (11 motherships and 369 catcher vessels) fishing in Area A (north of 45° N. latitude) in the North Pacific were scheduled to end operations between July 21 and 23. They were expected to have caught their quotas. The end would come about 8 days later than in 1967, the previous good pink salmon year, due to the unexpectedly light run of reds and chums. These caused the fleets to shift frequently.

#### Runs Near Shore Heavier

The salmon runs closer to shore were heavy compared with high-seas runs. So the land-based gill-net and longline fleets, which operated in Area B (south of 45° N. latitude), fared well. Fishing in Area B ended June 15 for longliners, and on June 23 for gill-netters. ('Suisan Keizai Shimbun,' July 16.)

* * *

### SUMMER ALBACORE FISHERY NEARS END

As of June 30, the Japanese summer pole-and-line albacore tuna catch was 27,500 metric tons. The fishery was near the season's end. Catches after that date were averaging around 50 tons a day of albacore mixed with skipjack.

As of June 30, landings of pole-caught albacore at principal ports were about: central Japan: 16,100 tons Yaizu; 5,800 tons Shimizu; 600 tons Misaki; 500 tons each Numazu and Choshi; southern Japan: 400 tons Kogoshima; northern Japan: 1,700 tons Nakaminato; 800 tons Onagawa; 250 tons Kesenuma; and 200 tons Ishinomaki.

#### Landings Above 1968's

Landings this year are substantially above the 1968 season's 17,300 tons--but are not likely to reach the 30,000 tons of 1967. ('Suisan Tsushin,' July 12.)

* * *

### EXPLORATORY TRAWLING IS DISAPPOINTING IN NORTHEAST ATLANTIC

The stern trawler 'Akebono Maru No. 51' (1,454 gross tons) is in the northeast Atlantic on a government-subsidized resource survey cruise. She recently completed fishing tests in the Bay of Biscay with little success. The vessel reported that the Bay has an abundance of cod and herring, but practically none of the species sought by Japan--octopus, squid, and red sea bream.

Akebono Maru is scheduled to extend operations northward toward the west coast of England for the second part of her cruise. However, the trawler's operators do not anticipate promising results. ('Minato Shimbun,' June 12.)

* * *

### TRAWLERS FACE CANADIAN RESTRICTIONS

The Japanese Fisheries Agency says Canada intends to declare as internal waters the landward side of the baseline connecting Vancouver Island and the Queen Charlotte Islands immediately after legislation is enacted around September. On June 11, Canada announced straight baselines. She defined her territorial sea and fishing limits along the coast of Vancouver Island and Queen Charlotte Islands on the west coast, and Nova Scotia on the east coast.

#### Negotiations May Be Necessary

Japan points out that Canada's claims will shut out Japanese trawl operations; already, these have been adversely affected by adoption of straight baselines. It might be necessary to negotiate with Canada for a fishery agreement similar to the one with the U.S.

The area to be affected by Canada's declaration is used now by Japanese trawlers primarily to load, although 1 or 2 trawlers also fish between the 2 islands.

#### Japanese Position

Japan has ratified the Convention on the Territorial Sea and the Contiguous Zone. She cannot protest the straight baseline system

Japan (Contd.):

recognized by that Convention. But she considers exclusion of foreign fishing vessels in the internal waters defined in connection with the straight baseline system as internationally illegal. Therefore, she plans to contact the Canadian Embassy in Tokyo about the matter. ('Minato Shimbun,' July 6.)

* * *

## TUNA PURSE SEINING FAILS COMPLETELY IN EASTERN PACIFIC

Japanese purse-seine operators were shocked to learn that the 4 tuna purse seiners that sailed in early January for the first time to the Eastern Pacific took only 340-350 tons. All 4 left the grounds between late April and early May. One Taiyo vessel and one Kinkai arrived in Japan at the end of May; the remaining two were en route to purse seine off Africa.

### Last Year's Method Fails

Last year, a Kawajiri Gyogyo vessel took nearly 1,000 tons of yellowfin from the same area. This year's plans of the 4 purse seiners were based on the same method. The result, however, was complete failure.

### Only Japanese Failed

Each U.S. purse seiner uses 3 or 4 speed boats to herd dolphin-chasing yellowfin into a net. Japanese purse seiners have no speed boats and cannot keep up with yellowfin. The Japanese failure, while catches by other countries were high, shocked Japanese fishermen. ('Shin Suisan Sokuho,' May 10.)

* * *

## TO SURVEY SKIPJACK TUNA IN SOUTHWEST PACIFIC

Japan is planning an extensive skipjack resource survey in the southwest Pacific, from Palau Island (U.S. Trust Territory) to south of New Guinea. The survey is to determine the potential for a pole-and-line skipjack fishery in the southern region, and to develop ways of keeping baitfish alive in the wells. The latter is a problem previously considered impossible to overcome.

### Chartered Survey Ship

The modern skipjack vessel 'Seishu Maru No. 7' (345 gross tons) will be chartered to conduct the survey from September or October until March 1970. The trip will be subsidized by the Mie prefectural government and supported by the Federation of Japan Tuna Fisheries Cooperative Associations. ('Katsuo-maguro Tsushin,' May 22 & 26.)

* * *

## FROZEN TUNA EXPORTS TO U.S. DROP

Owing to short supply, and U.S. rejections since late 1968, direct exports of frozen tuna to the U.S. during Jan.-May 1969 were down to 8,376 short tons worth US$3,666,236. Exports during same period 1968 were 21,239 tons worth $9,786,554.

Quantity and value of Atlantic transshipments to the U.S.--9,442 tons worth $3,418,021 Jan.-May 1969--were about the same as 1968 transshipments: 9,519 tons and $3,065,667. (Figures include tuna loin exports.)

### Domestic Packers Bought Much

May albacore exports to the U.S. amounted to 1,357 tons of direct shipments and 527 tons of Atlantic transshipments. Normally, June is the peak month for albacore exports, but this year's June shipments, as of the 15th, were only about 1,000 tons. Practically all the summer albacore taken off Japan were bought by domestic packers at high prices. There may not have been much left for export. ('Suisancho Nippo,' June 17.)

* * *

## HIGHER PRICES FIXED FOR CANNED TUNA EXPORTS TO U.S.

On July 8, the Tokyo Canned Tuna Sales Co. resumed sales of canned tuna-in-brine for export to the U.S. after a temporary suspension. It announced that a premium would be added to the present price for all can sizes.

The Sales Company will not apply the "fall clause" (contract provision to adjust prices in case of price decline) to the premium

Japan (Contd.):

added. The quantity for sale was not announced, but it was speculated that about half the stock of about 200,000 cases (mostly whitemeat tuna packed in 7-oz. cans) would be offered during a one-week period. The price and premium are shown below. ('Suisan Tsushin,' July 10.)

| Style of Pack | Can and Case Size | Present Price 1/ Per Case | Premium Per Case |
|---|---|---|---|
| | | (US$) | |
| Canned whitemeat tuna in brine: | | | |
| Solid: | 7-oz. 48's | 11.11 | 0.28 |
| | 13-oz. 24's | 10.33 | 0.28 |
| | 3½-oz. 48's | 6.66 | 0.17 |
| | 66½-oz. 6's | 12.33 | 0.42 |
| | 6.6-lb. 6's | 21.17 | 0.83 |
| Flake: | 6½-oz. 48's | 8.11 | 0.20 |
| Chunk: | 6.6-lb. 6's | 18.94 | 0.56 |
| Canned lightmeat tuna in brine: | | | |
| Solid: | 7-oz. 48's | 8.49 | 0.14 |
| | 13-oz. 24's | 7.86 | 0.19 |
| | 3½-oz. 48's | 5.11 | 0.08 |
| | 66½-oz. 6's | 9.30 | 0.28 |
| | 6.6-lb. 6's | 15.98 | 0.55 |
| Flake: | 6½-oz. 48's | 6.13 | 0.10 |
| Chunk: | 6.6-lb. 6's | 14.29 | 0.35 |

1/Ex-warehouse, Shimizu, Japan.

* * *

## CANNED TANNER CRAB EXPORT PRICES UP

The Japan Canned Salmon and Crab Sales Company announced 1969 export prices for canned tanner crab. The company also conducted its first tanner crab sales. About 25,000 cases were sold to trading firms for delivery in June and July. ('Suisan Tsushin,' June 5.)

Export Prices, 1969 and 1968

| Can Size | Choice | | Standard | |
|---|---|---|---|---|
| | 1969 | 1968 1/ | 1969 | 1968 1/ |
| | (US$/Case) | | | |
| 6½-oz. 24's | 12.65 | 9.95 | 12.40 | 9.70 |
| 6½-oz. 48's | 25.00 | 19.60 | 24.50 | 19.10 |
| 3¼-oz. 48's | 13.50 | 11.80 | 13.25 | 11.55 |

1/In 1968, promotion allowances also were offered to trading firms.

* * *

## FROZEN SHRIMP IMPORTS HIT HIGH IN MAY

In May 1969, Japan imported 4,232 metric tons of frozen shrimp worth about US$10.5 million. Although below April purchases of 4,817 tons worth $11.6 million, May imports exceeded 4,000 tons for the second time this year. India, Mexico, Thailand, Hong Kong, Pakistan, and Taiwan were the leading suppliers. ('Suisancho Nippo,' June 19.)

Frozen Shrimp Imports, May 1969

| Origin | May 1969 | | Jan.-May 1969 | |
|---|---|---|---|---|
| | Quantity | Value | Quantity | Value |
| | Metric Tons | US$ 1,000 | Metric Tons | US$ 1,000 |
| India | 640 | 1,353 | 1,776 | 3,608 |
| Mexico | 618 | 1,842 | 2,662 | 7,247 |
| Thailand | 519 | 1,203 | 2,678 | 6,050 |
| Hong Kong | 442 | 1,331 | 1,267 | 3,644 |
| Pakistan | 304 | 764 | 953 | 2,275 |
| Indonesia | 298 | 739 | 841 | 1,936 |
| Taiwan | 215 | 358 | 643 | 1,067 |
| Australia | 158 | 478 | 309 | 894 |
| Kuwait | 132 | 350 | 386 | 858 |
| Sabah (ex-North Borneo) | 114 | 250 | 598 | 1,250 |
| Malaysia | 111 | 236 | 468 | 1,042 |
| Others | 681 | 1,554 | 5,087 | 12,501 |
| Total | 4,232 | 10,458 | 17,668 | 42,372 |

* * *

## GEAR LOST OFF MEXICO

Data collected by the Federation of Japanese Fisheries Cooperative Associations (NIKKATSUREN) show that, since July 1968, 8 longliners lost 13 cases of gear while fishing off Mexico. Some 178 baskets of longlines (1 basket is 650-1,300 feet of line), 249 glass floats, 19 lamps, and one radio buoy were lost or damaged. Most of the longlines were severed by sharp instruments; 41 glass floats were damaged by rifle bullets. The vessels reported that the offenses were committed by small 40-50 ton purse seiners which fled into territorial waters when pursued.

### To Tell Mexico

NIKKATSUREN plans to submit the data to the government, requesting that Mexico be reminded of these incidents at the forthcoming meeting on the Japan-Mexico fisheries agreement.

During April-July 1968, 13 Japanese longliners fishing off Mexico suffered 13 cases of gear theft. They lost 418 baskets of long

Japan (Contd.):

lines, and 443 pieces of radio buoys, glass floats, banners, and lamps. ('Katsuo-maguro Tsushin,' June 18.)

## Taiwan

TUNA FISHERIES ARE IN TROUBLE

Taiwan's tuna fisheries are beset with difficulties--despite a record 1968 tuna catch of 79,000 metric tons (nearly 3 times the 1965 catch) and tuna exports to the U.S. worth US$25 million (only $2 million in 1965). Over half the vessel owners are unable to repay loans or modernize fishing gear and equipment.

The situation is expected to worsen with delivery of twenty 250-ton tuna vessels built in South Korea and financed from a $14.4 million loan granted Taiwan by the World Bank in 1967. Forty similar vessels will be built in Taiwan with a $10 million loan recently approved by the Asian Development Bank.

While production costs are rising, world market prices for tuna have stabilized in recent years.

What Taiwan Needs

The tuna fishery also lacks well-trained and experienced skippers and crews. It has poor marketing facilities. It depends almost entirely on Japan for bait and fishing gear.

Because of these problems, the Chief of the Fisheries Division of Taiwan's Joint Commission on Rural Reconstruction has recommended postponement for a few years of the planned expansion. (U.S. Embassy, Taipei, June 13.)

* * *

EXPORTS AND IMPORTS
FISHING VESSELS

The Nantai Shipbuilding Co. of Taiwan has won a contract to build fishing vessels for a Chinese firm in Indonesia.

Prices were: (1) US$175,000 for a 200-gross-ton, distant-water, vessel with main engine, freezer compartment, communication devices, and radar; (2) $30,000 for a 30-gross-ton coastal fishing vessel with engine, navigation instruments, and fishing gear.

Hong Kong Intermediary

The contract was negotiated through a Chinese merchant in Hong Kong because Indonesia does not have diplomatic relations with Taiwan. The Chinese firm in Indonesia learned that Taiwan builds as well and more cheaply than other countries. Before, all large Indonesian fishing vessels were imported from Japan.

Buys from S. Korea

The S. Korean Commerce and Industry Ministry reportedly has concluded a US$6.14 million contract with the Taiwan Central Trust Bureau to export twenty 250-gross-ton tuna vessels to Taiwan. The vessels, now being built at S. Korean shipyards, were scheduled for delivery by the end of August 1969. S. Korea hopes contract will lead to vessel orders from other countries. ('Suisan Keizai Shimbun,' June 6 & 16.)

According to information from the U.S. Embassy in Taipei, the 20 tuna vessels are financed by a World Bank loan to Taiwan in 1967. The contract with S. Korea was concluded then.

* * *

REQUESTS OBSERVER STATUS
AT IPFC MEETINGS

The Republic of China (Taiwan) has asked to participate as an observer at meetings of the FAO Indo-Pacific Fisheries Council (IPFC). The Council voted 14 to 10, with 4 abstentions, in favor of the request. Taiwan withdrew from FAO membership in 1952.

The IPFC was started in 1948 and has 18 members. Taiwan accounts for about 10% of total annual catch in Indo-Pacific area. (FAO, June 19.)

## South Korea

VALUE OF FISHERIES
IS INCREASING RAPIDLY

In first-half 1968, the value of South Korea's fishery output was 9.3 billion won (US$33.2 million), or 2.1 percent of her gross national product (GNP). ('Korean Business Review,' Dec. 1968.)

The fishery contribution to the GNP remained the same in 1968 as in 1967 because the entire economy grew as fast as the fisheries. In first-half 1968, fishery output increased 16.4% compared to 1967 production value of 8 billion won ($28.6 million). The GNP in the first half of 1968 grew at a rate of 17.2%. Both rates are practically unmatched in world economies.

Latest estimates by the Ministry of Agriculture indicate value of 1968 fisheries exceeded 18.5 billion won (US$66 million) in constant 1965 prices.

* * *

TO EXPORT TUNA LONGLINERS
TO EL SALVADOR

S. Korea plans to build and export in 1969 11 tuna vessels (235 gross tons each) to El Salvador on a deferred-payment basis. The terms are US$338,738 per vessel payable in installments over 4 years. This includes a 1-year grace period. Interest rate is 7.75% a year. S. Korea will send 33 senior crew members (captains, radio operators, and engineers) to El Salvador to man vessels. ('Suisan Keizai,' Apr. 1.)

Sale Follows Survey

The sale follows the October 1968 agreement between Korean Office of Fisheries and El Salvador. The Korean Fisheries Mission visited El Salvador in March 1969. It recommended reorganization of fisheries programs, increase in staff and budgets, a Ministry of Fisheries to include research training and statistical collection, drafting of development plan, and organization of fishermen's training center.

Mission Recommendations

The Korean Mission recommended that all longliner tuna catches be frozen and sold on world markets because it could not find markets for tuna and allied fish in Central America. Also, it recommended establishment of a longline fishery rather than purse-seine or bait-boat fishery for tuna. The standard longline boat of 240 gross tons recommended agrees with reported tonnage of the 11 longliners ordered.

ARE THERE REALLY SEA MONSTERS?

Although we discount the fabled sea monsters, such as the kraken which could swallow vessels whole, we have not yet explored the ocean thoroughly enough to say with absolute certainty that there are no monsters in the deep.

Scientific observations and records note that giant squids with tentacles 40 feet long live at 1,500 feet and that sizable objects have been detected by explosive echo sounding at greater depths.

Oarfish 40 to 50 feet long also have been observed by scientists. Either the oarfish or the giant squid with its long tentacles may have given rise to the sea serpent stories told by sailors of old.

In recent years, Danish scientists have studied large eel larvae that would grow to 90 feet if their growth rate is the same as eels of other species. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

# MID EAST

## Israel

BROADENS OCEANOGRAPHIC WORK

Prof. Moshe Shilo has summarized Israeli oceanography and limnology. He is associated with the National Council of Research and Development.

The limnological laboratory at the Sea of Galilee now has adequate equipment and staff. The laboratory is nearly ready to study the lake's ecology, geology, microbiology, biology, and physical and chemical limnology.

Red Sea Station

The Marine Biological Research Station at Eilat is a going concern. Prof. Heinz Steinitz, Professor of Zoology, Hebrew University of Jerusalem, is slated to be named director.

Haifa Institute

Construction of the Institute of Oceanography and Limnology at Tel Shikmona, on the outskirts of Haifa, will begin in a few months. Scheduled for completion in 3 years, it will be the center for all major oceanographic research. It will include the Sea Fisheries Research Station.

Vessels

The sea-going oceanographic vessel 'Shikmona' is being outfitted for more extensive and sophisticated research. A catamaran has been purchased for in-shore investigations. Also, propeller-driven boats of the Florida Everglades type are on order to broaden investigations at Bardawil Lagoon, near El Arish, in Sinai.

A hydrographic, geologic, and oceanographic coast survey offshore to 100 kilometers, and from Lebanon to Port Said, has been completed. Although possible offshore deposits of petroleum were explored, its immediate purpose was to locate sand suitable for construction. Hydrographic maps are expected to be issued soon. (U.S. Embassy, Tel Aviv, July 5.)

## Qatar

EXPORTS SHRIMP
TO U.S. AND JAPAN

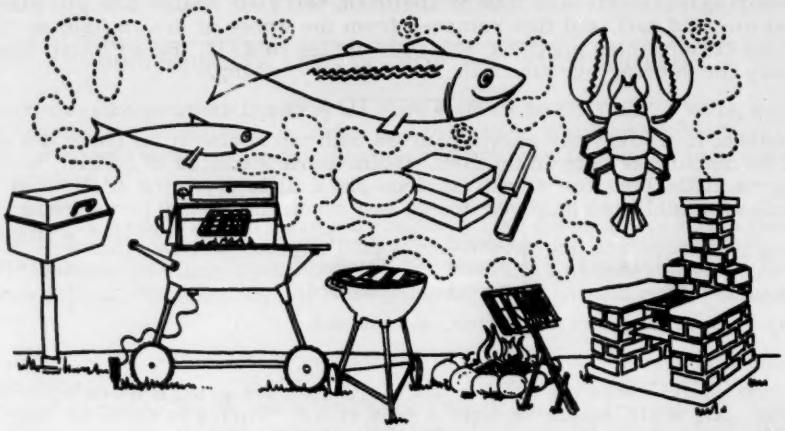
Qatar is a small, oil-producing skeikdom on a Persian Gulf peninsula. Fishing is part of its economy. For the Qatar National Fishing Co., 1968 was an active year. (Its private investors hold 45%; government, 15%; Ross Group, 40%.) The company's modern refrigerated plant processed over 260 metric tons of shrimp. Processed shrimp now is being exported to the U.S. and Japan.

Progress in 1968

Significant strides were made in 1968 to improve Qatar's economy. The Doha Port Project awarded to the European consortium in 1967 was virtually complete at the end of the year. It includes a new 4-berth quay with an inner channel 1.5 miles long and 400 feet wide, and a maneuvering basin a half-mile square.

In April 1968, another contract estimated at US$204,000 was awarded to a Canadian firm for construction of two 200-foot span warehouses to provide 160,000 square feet of storage space. (U.S. Consulate, Dhahran, July 9.)

## FOOD FISH FACTS



Outdoor Fish Cookery.

Thousands of people agree that food rarely tastes better than when properly cooked out-of-doors. The reason? Probably because the open air, the relaxed, congenial atmosphere, and the tantalizing aroma of outdoor cookery all combine to whet the appetite and sharpen the taste.

Fish and shellfish are no exception to this happy rule, and almost all varieties adapt readily to outdoor cooking and eating. Whether your equipment is a simple charcoal grill, an elaborate electric or gas grill, or a primitive campfire, the results can be equally successful and the eating equally good. The four important rules to remember for successful outdoor seafood cookery are:

1. Care in selecting and preparing the fish and shellfish;
2. Cooking the seafood until just flaky when tested with a fork. Overcooking of tender, succulent fish and shellfish is apt to toughen and dry them;
3. Controlling the heat; and
4. Marinating, basting, or coating the fishery products to keep the juices in and dryness out.

### HOW TO BUY

Fish are marketed in various forms for different uses. Know these forms or "cuts" when you buy:

WHOLE - as the fish comes from the water. Before cooking, it must be eviscerated and scaled; usually the head, tail, and fins are also removed.

DRAWN - whole, eviscerated fish. Usually the head, tail, and fins removed.

DRESSED OR PAN-DRESSED - whole, eviscerated and scaled fish. Usually the head, tail, and fins are removed. Ready to use.

STEAKS - cross-section slices from large dressed fish. Ready to use.

FILLETS - sides of the fish, cut length-wise away from the backbone. Ready to use.

STICKS AND PORTIONS - pieces of fish cut from blocks of frozen fillets and having uniform sizes, ranging in weight from one to several ounces. Ready to use.

CANNED FISH - includes many varieties of both fish and shellfish.

(Continued following page.)

When ordering fresh or frozen fish or shellfish, tell your dealer how you plan to serve it. If you wish the head, tail, and fins removed from the whole or drawn fish, or if you wish the fish cut into serving-size portions, ask your dealer to do it. He will also open oysters or clams ready for serving--or shuck them ready for cooking.

## HOW MUCH TO BUY

The amount of fish to buy per serving varies with the recipe to be used, the size of the serving, and the amounts of bone in the fish. Count about 3 ounces of cooked, boneless fish as a serving--a little less for small children and a little more for adolescent boys and men. The following table can help you decide how much fish to buy per serving:

| | | | |
|---|---|---|---|
| Whole | $\frac{3}{4}$ pound | Portions | $\frac{1}{3}$ pound |
| Dressed or pan-dressed | $\frac{1}{2}$ pound | Sticks | $\frac{1}{4}$ pound |
| Fillets or steaks | $\frac{1}{3}$ pound | Canned | $\frac{1}{6}$ pound |

Fish may be purchased fresh, frozen, and canned.

## OPERATING A GAS GRILL

To light the grill--raise the hood or uncover. Remove grid, if manufacturer recommends. Strike long style match or light a soda straw. Turn gas valve to "high"--follow manufacturer's instructions if grill has pilot light. Hold match at ignition point.

Leave valve on "high" to preheat, but do not lower hood. If burner is below food, preheat for 10 to 15 minutes. If burner is above food, preheat for one minute.

Before placing food on grid or rotisserie, adjust valve to proper setting. Experience and personal preference will help you learn best setting. With outdoor grills, allow for climate conditions.

Follow manufacturer's directions for cooking on grid and rotisserie and for grill cleaning.

## OPERATING A CHARCOAL GRILL

If your grill is of the charcoal variety, here's how to start the fire:

Line the bottom of the fire bowl with heavy-duty aluminum foil for easier cleaning later. To prevent the grill from burning out, line the bottom of the firebox with a layer of small pebbles or vermiculite. This permits the fire to breathe, giving more heat from the coals. Make charcoal layer slightly wider all around than the food to be cooked on the grill.

Start the fire sufficiently in advance so you will have a good bed of coals when you start barbecuing. One method used, which takes about 45 minutes, is to stack briquets in pyramid, and soak lightly with any recommended charcoal lighting fluid. Let stand 1 minute, then light. Many commercial forms of lighter fluid, easily ignited mats, and other lighting aids are available. WARNING: AT ALL TIMES TAKE NECESSARY PRECAUTIONS WHEN LIGHTING THE FIRE. NEVER USE GASOLINE! When the surface is covered with a gray ash, spread the coals evenly and the fire is ready.

## FOR SMOKY FLAVOR

Wood chips from apple, oak, maple, hickory, and cherry give smoke flavor to fish. Soak chips in water at least an hour before using, so they will give maximum smoke and not burn too rapidly. On a charcoal grill, add a few chips at a time to the charcoal while cooking. If chips flame up, add more wet chips. For a gas grill, scatter wet chips directly on the ceramic briquets for added flavor, or--for a more subtle flavor--wrap them in perforated foil before placing them on the briquets.

## REMEMBER

NEVER OVERCOOK FISH. Cook only until they flake easily when tested. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Rm. 526, Chicago, Ill. 60611.

(Recipe and photo pp. 75-6.)

## FISH SQUARES ARE "IN" FOR THE "OUT" CROWD

Summertime--the weather is balmy and you want to be OUTSIDE. Well, summertime's the right time to forget formality--so, relax and enjoy life. Whether you're feeding the family or the boss, go ahead--now is the time to cook and eat outside where the breeze is soft and the sun is warm.

What could be simpler than ready-in-minutes fish portions cooked to perfection on a grill? Freezer-ready portions are great anytime of year and are especially appropriate in the summer when the less time spent cooking--the better! Whether you're planning a dinner on the patio, a picnic, or a camping trip, fish portions are right and ready, no muss--no fuss, just good eating.

The Bureau of Commercial Fisheries has a new recipe, "Charcoal Broiled Portions With Choron Sauce", which is great for special occasions. The Choron Sauce, a variation of world-famous Bearnaise Sauce, elevates the practical, good-every-day fish portion into the gourmet class. Quickly cooked corn on the cob and flavorful broccoli or other in-season vegetables complete the feast. Be sure to have plenty of fish portions on hand; they will be eaten almost as quickly as you can grill them.

Did you know that fish portions are generally made from groundfish which includes cod, haddock, and pollock? The tender, serving-size pieces are cut from frozen blocks of fish fillets and are 100 percent edible. Portions are always sold frozen and may be purchased breaded or unbreaded and either raw or partially cooked. They come in a variety of sizes and shapes to fit all needs. Keep frozen until ready to use, and cook without thawing. Fish portions may be baked, deep-fat fried, oven-fried, pan-fried, broiled, or charcoal broiled on a grill.

### CHARCOAL BROILED PORTIONS WITH CHORON SAUCE

12 frozen raw breaded fish portions (2½ to 3 ounces each)
1 cup oil
Paprika
Choron Sauce

Dip frozen portions in oil and sprinkle with paprika. Place portions in well-greased, hinged, wire grills, cook about 4 inches from moderately hot coals for 5 to 7 minutes. Turn. Cook for 5 to 7 minutes longer or until fish are brown and flake easily when tested with a fork. Serve with Choron Sauce. Makes 12 servings.

### Choron Sauce

½ cup butter or margarine
¼ cup water
4 egg yolks
2 tablespoons tarragon vinegar
1 teaspoon instant minced onion
1 teaspoon dried parsley flakes
¼ teaspoon salt
Dash cayenne
3 tablespoons tomato paste

Melt butter in water in top of double boiler over direct heat. Remove from heat. Add egg yolks. Beat until mixture almost doubles in bulk. Stir in vinegar, onion, parsley, salt, and cayenne. Cook over hot water 5 minutes or until thick, stirring constantly. Remove from heat. Stir in tomato paste. Serve warm. Makes approximately 2 cups sauce.

Want to know more about outdoor seafood cookery? The Bureau of Commercial Fisheries has published a 24-page, full-color booklet that is filled with information on how to buy and prepare fish, how to build and light the fire, and 36 wonderful recipes for your use. "Fish and Shellfish Over the Coals" (I 49.39:14) costs 40¢ and is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Source: National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio, Room 526, Chicago, Illinois 60611.

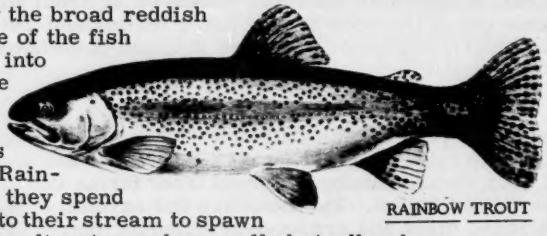
FISH SQUARES ARE "IN" FOR THE "OUT" CROWD (Contd.)

## FOOD FISH FACTS

Rainbow trout are known for the furious leaps and runs they make when caught in swift, cool, white-water rivers. These aerialists of the trout family are spectacular fighters and give a strong battle to fishermen.

## DESCRIPTION

Rainbow trout are easily identified by the broad reddish band or "rainbow" which runs along the side of the fish from head to tail. The reddish band blends into a dark olive green on the back and pure white or silvery on the belly. The back, dorsal fin, and tail are generously sprinkled with black spots. The brightness of color varies with where the fish lives and what it eats. Rainbow sometimes migrate to the ocean where they spend several years of their life. When they return to their stream to spawn they have acquired a grayish tinge from the salt water and are called steelhead.



RAINBOW TROUT

## HABITAT

The rainbow is a native of the Pacific slope of the Sierras from California to Alaska. It has since been transplanted to nearly every state in the Union. Trout prefer clear, cool, unpolluted water and are usually not found in waters without these qualities.

## LIFE HISTORY

Wild rainbows usually spawn in the spring during their second or third year of life. The female deposits the eggs in the gravel of the streambed. The size of the female determines the number of eggs produced. In 8 weeks or more, depending on water temperature, the eggs hatch. The growth rate of the newly hatched fish varies and depends on such factors as water temperature, food supply, and water chemistry. From the many eggs deposited in the gravel, only a few young fish survive to adulthood. Therefore, relatively few trout reach catchable size to be taken by fishermen.

## TROUT FARMING

Wise homemakers know, however, that they don't have to rely on the whims of nature to enjoy trout at mealtime. Modern trout farms raise their tempting fish for the tables of America. Using modern scientific equipment, trout farms create the best environmental and feeding conditions for fast-growing, healthy trout. Careful selective breeding has produced strains of rainbow trout that grow bigger and faster than their wild counterparts.

When grown to the correct size, these meaty delicacies are carefully selected for market. They are then cleaned and packaged for fresh or frozen distribution throughout the country. Modern technology is used in every phase from hatching to the finished package.

## MARKET FORMS

Because of modern freezing and shipping techniques, frozen rainbow trout are available nationwide at almost anytime of the year. All trout are sold with head and tail attached. Frozen trout are sold fresh-frozen, boned, and boned and breaded. Boned trout have the backbone and ribs removed. Boned and breaded trout have the fins, backbone, and ribs removed. Frozen trout are usually sold in 8-ounce packages. Each package contains two 4-ounce trout.

Fresh trout, packed in ice, are also available in many areas. Those trout displayed in many seafood markets are usually 5, 6, 8, or 10-ounce fish. Trout of these weights are also tray-packaged by supermarkets to meet the needs of their customers. (Source: Bureau of Commercial Fisheries, U.S. Department of the Interior.)

(Recipe on p. 78.)

## HOW ABOUT A TREAT WITH TROUT?

How about rainbow trout for dinner? Trout can be baked, deep fried, pan fried, broiled, poached, grilled, or barbecued. Any way you prepare them, rainbow trout are good eating.

For a special treat, try "Southern Baked Rainbow Trout," a new recipe from BCF. Bureau Home Economists took the goodness of trout and added one of the tastiest stuffings ever to come out of the deep South. After testing and retesting, they declared this recipe to be just the right combination to please the man of the house or those guests you want to surprise with something deliciously different.

Rainbow trout, a favorite of game fishermen because of their fighting spirit, are now available year round to all those fishermen who prefer to do their fishing at seafood counters. They are raised in great numbers in large ponds of cold, clear, running water on trout farms in the United States. The trout are fed carefully balanced diets and are hand-selected for market while they are still swimming. They are cleaned and packaged, fresh or frozen, minutes after being caught.

The flesh of rainbow trout is firm and white when cooked and is delicately flavored. It is high in nutritive value containing high quality, easily digested protein. Trout is also an excellent source of vitamins while being low in fat. Market forms include whole, dressed, filleted, boned, and breaded. For best results, thaw the trout before cooking and do not overcook. Frozen trout are usually sold in packages containing two 4-ounce trout. Fresh trout, packed in ice, are usually from 5 to 10 ounces in weight.

### SOUTHERN BAKED RAINBOW TROUT

6 pan-dressed rainbow trout or other pan-dressed fish, fresh or frozen
Salt
Cornbread Stuffing
2 tablespoons butter or margarine, melted

Thaw frozen fish. Clean, wash, and dry fish. Sprinkle inside of fish with salt. Place fish in a single layer on a well-greased bake and serve platter, 16 x 10 inches. Stuff fish loosely. Brush fish with butter. Bake in a moderate oven, 350° F., for 20 to 30 minutes or until fish flake easily when tested with a fork. Makes 6 servings.

### CORNBREAD STUFFING

½ pound mild pork sausage meat
½ cup chopped celery
½ cup chopped onion
2 cups toasted cornbread cubes
½ cup chicken broth
½ teaspoon poultry seasoning
½ teaspoon sage

Fry sausage meat until crumbly and brown. Add celery and onion. Cook until tender. Add remaining ingredients and mix well. Makes approximately 2 cups stuffing.

(Source: National Marketing Services Office, Bureau of Commercial Fisheries, U.S. Dept. of the Interior, 100 East Ohio, Room 526, Chicago, Illinois 60611.)

Today's modern homemaker knows the value of time. With her in mind, BCF has produced a full-color recipe booklet, "Time For Seafood." Fish and shellfish are natural timesavers and the booklet is filled with short, attractive, and flavorful recipes developed as the basis for quick, complete meals. "Time For Seafood," Fishery Market Development Series No. 12, is available for 45¢ from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE

BUREAU OF COMMERCIAL FISHERIES